The Ohio Valley Coal Company
ARP R-360-70
Environmental Specialist Review
R. Scott Stiteler
9-21-2010
Revised 11-19-10

1. ✓ Item 2: This item indicates that Part 2 and 4 of the mining and reclamation plan is being revised. Revise to indicate specifically what sections and item numbers of these Parts are being revised. Note: No revised pages from Part 2 of the application were submitted.

2. ✓ Item 5: The response indicates that the facility will be protected from material damage. Revise to address if the reasonable foreseeable use of this facility will be reduced or protected.

3. ✓ Dr. Luo's Report: Revise page 3 to indicate that the equipment building is a concrete block structure not a wood frame structure.

4. Revise to show the subsidence control survey number 21-28 on the map.

5. ✓ Revise to include the approved FAA and The Ohio Valley Coal Company agreement with this ARP.

Stiteler, Scott

To: Heavilin, Brent
Cc: Murphy, Shawn
Subject: FW: FAA towers - permitting revisions

Based off my comments from 9-21-10 (attached) none of the items appears to be completely addressed.

Items 1, 2 & 4. Still need to revise.

Item 3 (Dr. Lou's report) They did indicate on the subsidence control plan (attached) that Dr. Lou's report was revised to account for the correct building construction of concrete block. The revised addendum says it is attached but it was not.

Item 5 (Agreement) . Shouldn't this agreement be signed or included with a cover letter from the FAA (one they sent last week)?

If you have any questions please let me know.

-----Original Message-----
From: Heavilin, Brent
Sent: Thursday, December 30, 2010 12:32 PM
To: Stiteler, Scott; Murphy, Shawn
Cc: Grant, Sue
Subject: FW: FAA towers - permitting revisions

Please take a look at these revisions. If we incorporate them into the ARP do they answer all our questions? We may want to distribute these to the reviewers and send an official revision letter to OVCC.

-----Original Message-----
From: Bartsch, David [mailto:dbartsch@coalsource.com]
Sent: Thursday, December 30, 2010 11:28 AM
To: Heavilin, Brent
Cc: Witt, Jason; Stemm, Mark S.; Erdos, Lanny
Subject: FW: FAA towers - permitting revisions

Brent,

We have executed the agreement with the FAA. Per that agreement, the attached revisions are submitted. They include the terms of the agreement and some changes to the subsidence control plan. If you have any questions, please contact me.

David L. Bartsch, P.E.
Environmental Coordinator and Permit Administrator
The Ohio Valley Coal Company
56854 Pleasant Ridge Road
Alledonia, OH 43902
Phone: 740-926-1351 x260
Fax: 740-926-9112
Mobile: 740-310-9410

THE OHIO VALLEY COAL COMPANY
POWHATAN NO. 6 MINE
PERMIT D-0360
ADDENDUM TO SUBSIDENCE CONTROL – PROTECTION OF SPECIFIC STRUCTURES

SUBSIDENCE CONTROL PLAN

Dr. Luo revised his mitigation plan upon learning that the control building at the RCAG site was of different construction. Attached is his recommendation for the mitigation for the building and constitutes what will be done in addition to the recommendations in the original report.

__________ New Submittal
__________ Revised Submittal R-__________

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

APPLICATION TO REVISE A COAL MINING PERMIT

Note: Refer to the division's "General Guidelines for Processing ARPs" and "Requirements for Specific Types of Common ARPs" for guidance on submitting and processing ARPs.

1. Applicant's Name **THE OHIO VALLEY COAL COMPANY**

   Address **56854 PLEASANT RIDGE ROAD**

   City **ALLEDONIA** State **OH** Zip **43902**

   Telephone Number **740-926-1351**

2. Permit Number **D-0360**

3. Section of mining and reclamation to be revised:

   PART 4 SUBSIDENCE CONTROL PLAN

4. Describe in detail the proposed revision and submit any necessary drawings, plans, maps, etc:

   THIS REVISION CHANGES THE MINING UNDER TOWERS OWNED BY THE FEDERAL AVIATION ADMINISTRATION FROM ROOM AND PILLAR MINING TO FULL COAL RECOVERY MINING

5. Describe in detail the reason for requesting the revision:

   THIS REVISION IS NEEDED TO MAKE BETTER USE OF THE RESERVE AND NOT SKIP THE LONGWALL MINING AROUND STRUCTURES THAT CAN BE PROTECTED FROM MATERIAL DAMAGE AND THAT THE REASONABLE FORSEEABLE USE OF THE FACILITY WILL BE PROTECTED

6. Will this revision constitute a significant alteration from the mining and reclamation operations contemplated in the original permit? ☒ Yes, ☐ No.
   (Note: refer to paragraph (E)(2) of 1501:13-04-06 of the Ohio Administrative Code to determine if a revision is deemed significant.)

   If "yes," complete the following items 7 through 9.

7. In the space below, give the name and address of the newspaper in which the public notice is to be published.

   THE TIMES LEADER
   200 S. 4TH STREET
   MARTINS FERRY, OH 43935

THE OHIO VALLEY COAL COMPANY
POWHATAN NO. 6 MINE
PERMIT D-0360
ADDENDUM TO SUBSIDENCE CONTROL – PROTECTION OF SPECIFIC STRUCTURES

SUBSIDENCE CONTROL PLAN

Dr. Luo revised his mitigation plan upon learning that the control building at the RCAG site was of different construction. Attached is his recommendation for the mitigation for the building and constitutes what will be done in addition to the recommendations in the original report.

December 7, 2010

Mr. David L. Bartsch
Environmental Coordinator and Permit Administrator
The Ohio Valley Coal Company
56854 Pleasant Ridge Road
Alledonia, OH 43902

RE: Modification to 6/8/2010 Report

Dear Mr. Bartsch

The letter is to make a minor correction to the report "Assessment of Subsidence Influences and Recommended Mitigation Measures for FAA Belmont Station, Belmont, OH" submitted on June 8, 2010. It is referred to the construction and mitigation measures for the Control Building.

In the report, the super-structure of the control building was mistakenly recognized as a simple wood-frame structure. However, it was later discovered that the walls of the superstructure are built with concrete blocks and covered with siding. Due to the heavier weight of the wall structure than wood-frame structure, it is recommended to wrap the walls with one steel cable at a level about two feet below the gutter line. In order for the tension cable method to be more effective, the siding at the building corners at the cable level should be removed. Wood bracing should be inserted between the tension cable and the wall corners. The cable should be tensioned to 2.5 tons (5,000 lbs) during its service life. The cable can be removed and siding reattached after the longwall face has past the control building a distance of 600 ft.

Sincerely Your;

STATE OF OHIO
YI LUO
72182
REGISTERED
PROFESSIONAL ENGINEER

Yi Luo, Ph.D., P.E.

Associate Professor
Department of Mining Engineering
West Virginia University
Morgantown, WV 26506-6070

THE OHIO VALLEY COAL COMPANY
POWHATAN NO. 6 MINE
PERMIT D-0360
ADDENDUM TO SUBSIDENCE CONTROL – PROTECTION OF SPECIFIC STRUCTURES – ITEM 2

SUBSIDENCE CONTROL PLAN

OVCC reached agreement with the Federal Aviation Administration ("FAA") on measures to protect the FAA's Belmont RCAG site from longwall subsidence damage and to safeguard the flying public during undermining. The portions of the agreement relevant to the subsidence control plan are reprinted and incorporated as a part of this addendum.

In addition, pursuant to section C.7 of OVCC's agreement with the FAA, OVCC commits to repair damages to the Belmont RCAG site resulting from OVCC's longwall mining even if such damage arises after the term of OVCC's agreement with the FAA.

U.S. Department
of Transportation

Federal Aviation Administration

Great Lakes Region
Regional Counsel, AGL-7M
2300 East Devon Avenue
Des Plaines, Illinois 60018

T (847) 294-7313
F (847) 294-7498

Regular Mail & Facsimile (614) 265-7998

December 29, 2010

John F. Husted, Chief
Ohio Department of Natural Resources
Division of Mineral Resources Management
2045 Morse Road, Bldg. H-3
Columbus, OH 43229-6693

Re: Permit Application Number D-360-23

Dear Mr. Husted:

The Federal Aviation Administration (FAA) and The Ohio Valley Coal Company (TOVCC) have reached agreements to assure that pre-mining mitigation measures to prevent material damage to structures and facilities will be implemented, that FAA operations at the Belmont RCAG site will be temporarily relocated at the FAA's expense prior to mining, and that the cost of any damage caused by TOVCC's mining notwithstanding the mitigation measures will be fully paid by TOVCC pursuant to the parties' agreement. Assuming compliance with the parties' agreement, the FAA does not object to TOVCC's mining beneath the Belmont RCAG.

If you have any questions, please contact Jeanette Daubaras or Briana Martino at (847) 294-7313.

Sincerely,

Briana Martino

Briana Martino
Federal Aviation Administration Attorney

cc: R. Scott Stiteler, ODNR, Scott.Stiteler@dnr.state.oh.us
B. Heavilin, ODNR, Brent.Heavilin@dnr.state.oh.us
M. Stemm, TOVCC Counsel, MStemm@porterwright.com
J. Witt, TOVCC Counsel, jwitt@coalsource.com

SUBSIDENCE CONTROL PROVISIONS EXCERPTED FROM:

NON-FEDERAL REIMBURSABLE AGREEMENT

BETWEEN

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

AND

THE OHIO VALLEY COAL COMPANY
56854 PLEASANT RIDGE ROAD
ALLEDONIA, OHIO 43902

A. This Agreement assures the FAA and the public that FAA operations will not be interrupted by mining. The advance funding of this Agreement between the FAA and the Sponsor and Article 3, Section C.7 ensure that funding will be in place to remedy any damages caused by mining to the FAA's Belmont RCAG facility in Belmont County, Ohio in the event pre-mining mitigation measures, documented in Attachment 1: TOVCC Pre-Mining Mitigation Measures, implemented at the Sponsor's expense, outside the scope of this Agreement, do not prevent all damages. This Agreement provides funding for the FAA to establish these services. With this in mind, this project is titled:

   Mitigation & Repair of Damage from Mining Beneath Belmont RCAG

   The Sponsor shall not conduct mining within 500 feet of the fence line of the FAA's Belmont RCAG site until the FAA has completed the work necessary to temporarily transfer the functions of the Belmont RCAG facility to facilities located outside Sponsor's mining area.

   The terms and conditions outlined in this Agreement are based upon the Sponsor beginning mining operations under the Belmont facility within one (1) year of execution of this Agreement.

B. The FAA will perform the following activities:

   1. Within three days after the execution of this Agreement, the FAA shall communicate in writing to the Chief of the Ohio Department of Natural Resources (ODNR), Division of Mineral Resources Management (DMRM) that the FAA and the Sponsor have reached agreements to assure that pre-mining mitigation measures to prevent material damage to structures and

facilities will be implemented, that FAA operations at the Belmont RCAG site will be temporarily relocated at the FAA's expense prior to mining, and that the cost of any damage caused by the Sponsor's mining notwithstanding the mitigation measures will be fully paid by Sponsor pursuant to this Reimbursable Agreement. The FAA shall further state in its written communication to DMRM that the FAA does not object to the Sponsor's mining beneath the Belmont RCAG.

2. No later than April 15, 2011, the FAA at its expense shall complete the work necessary to temporarily transfer the functions of the Belmont RCAG facility to facilities located outside Sponsor's mining area during Sponsor's undermining of the Belmont RCAG facility.

3. The FAA shall grant Sponsor and its employees and contractors access to the Belmont RCAG site when and to the extent required to implement the pre-mining mitigation measures described in Attachment 1 and to conduct any pre-mining surveys or post mining inspections.

4. The FAA, jointly with the Sponsor, shall conduct a pre-mining survey of the Belmont RCAG site to document its condition before Sponsor implements the mitigation efforts outlined in Attachment 1: TOVCC Pre-Mining Mitigation Measures and before Sponsor begins mining beneath the site. Such survey shall, at a minimum, include those requirements outlined by Attachment 2: Survey & Inspections.

5. The FAA shall conduct post-mining inspections of the Belmont RCAG site to assess and document the site's condition after undermining. Such inspections shall, at a minimum, include those requirements outlined by Attachment 2: Survey & Inspections. The FAA shall provide notice to Sponsor of the time and date of the FAA's inspections and permit Sponsor to conduct post-mining inspections simultaneously pursuant to Article 3, Section C.6 of this Article.

6. The FAA shall conduct its post-mining inspections of the Belmont RCAG site according to the following approximate schedule:
    a. At the time the undermining has progressed to 700 feet beyond the fence line of the facility;
    b. Thirty (30) calendar days after the first post-mining inspection;
    c. Sixty (60) calendar days after the first post-mining inspection;
    d. Ninety (90) calendar days after the first post-mining inspection; and
    e. Three Hundred Sixty (360) calendar days after the first post-mining inspection.

7. Within ten (10) business days of each of the FAA's post-mining inspections, the FAA shall itemize for Sponsor, in writing, the subsidence damages it determined require repair.

8. Within thirty (30) calendar days of each of the FAA's post-mining

inspections, the FAA shall notify Sponsor of the estimated repair cost for each damaged item identified pursuant to each of the post-mining inspections and provide the documents supporting the estimate. If replacement cost is less than repair cost, the FAA shall proceed with the lesser replacement cost.

9. The FAA shall secure contracts to repair damages identified by each of the post-mining inspections. These contracts shall be funded by the Sponsor in accordance with the terms of this Reimbursable Agreement.

10. If no further subsidence or damage is reported by the FAA's third post-mining inspection, as outlined in Article 3, Section B.6, the FAA shall release to the Sponsor within sixty (60) days eighty percent (80%) of the amount of escrowed funds in excess of the amount of the estimated repair cost documented by the FAA's prior post-mining inspections pursuant to Article 3, Section B8.

11. If no further subsidence or damage is reported by the FAA's fifth post-mining inspection, occurring three hundred sixty (360) days after the first post-mining inspection as outlined in Article 3, Section B.6, the FAA shall release to Sponsor the remaining amount of escrowed funds within sixty (60) days.

12. The FAA shall determine the completion of the terms and conditions of this Reimbursable Agreement.

C. The Sponsor will perform the following activities:

1. The Sponsor shall withdraw its Notice of Appeal from a decision of the Division Chief relating to the mining plan addressed under adjacent area application D-360-23, filed on August 30, 2010, within three days of the execution of this Reimbursable Agreement.

2. The Sponsor, jointly with the FAA, shall conduct a pre-mining survey, in accordance with Article 3, Section B4 and Attachment 1: TOVCC Pre-Mining Mitigation Measures, of the Belmont RCAG site to document its condition before undermining.

3. The Sponsor shall provide to the FAA monthly reports of current progress and mining location beginning with the execution of this Agreement.

4. The Sponsor shall report to the FAA when the proximity of mining is within 500 feet of the fence line of the facility, and thereafter provide daily progress reports from this point until such time that mining progresses 700 feet beyond the fence line of the Belmont RCAG site.

5. The Sponsor shall conduct, at the Sponsor's expense, the mitigation efforts outlined in Attachment 1: TOVCC Pre-Mining Mitigation Measures after the FAA completes the work described in Article 3, Section B2 , with Sponsor completing its mitigation efforts prior to mining within 500 feet of the fence line of the facility.

6. The Sponsor may conduct post-mining inspections of the Belmont RCAG site to document its condition after mining under the site. Sponsor may conduct

post-mining inspections to coincide with each inspection conducted by the FAA. Repairs necessary due to mining damage to the site shall be determined at the discretion of the FAA and funded by the Sponsor through the terms of this Agreement. Repair of off-site damage outside the boundaries of FAA property shall be funded by the Sponsor through the terms of this Agreement only if the damage to such off-site areas threatens the operational capability of the Belmont RCAG facility as determined by the FAA. The boundaries of the FAA property include the access road from main highway to the FAA facility.

7. Upon execution of this Agreement, the Sponsor shall submit to the ODNR a revision to their permit indicating their willingness to repair damages to the Belmont RCAG site resulting from Sponsor's mining, including any damage discovered after this Agreement has been terminated.

8. In accordance with Article 9, the Sponsor shall provide additional funding to repair damages caused to the Belmont RCAG site resulting from Sponsor's mining within forty-eight (48) hours of notification by the FAA if the amount held in escrow is insufficient to cover the estimated cost of repairs.

Agreement Attachment 1: TOVCC Pre-Mining Mitigation Measures

1. After the FAA has completed the work necessary to temporarily transfer the functions of the Belmont RCAG facility to other facilities located outside Sponsor's mining area and before mining has reached within 500 feet of the fence line of the Belmont RCAG site, Sponsor, at its expense outside the scope of the funding provided by this Agreement, shall implement:

   a) the pre-mining mitigation measures recommended by Dr. Luo in his report dated June 8, 2010 (copy attached as Exhibit A);

   b) the bracing recommended by Joseph "Nick" Kozak in his Affidavit dated July 20, 2010 to reinforce the equipment racks (copy attached as Exhibit B); and

   c) Tri-County Tower Company's recommended replacement of any guy wires in poor condition and inspection of anchor points.

   d) To the extent not implemented by the aforementioned mitigation measures, Sponsor shall also implement the following:

      i. Mitigation Measures as described in Dr. Luo's report.
      ii. Brace tower structures using Dr. Luo's methods;
      iii. Brace building foundation;
      iv. Expose buried cables from antennas or towers to control building;

v. Brace or secure equipment (TELCO responder cabinet, radio racks, power system, water pump/tank, exterior RF junction boxes, etc.);

vi. Ensure incoming utilities and poles are adequately protected to assure continuing utility service to the site;

vii. Secure HVAC, conduits, and piping;

viii. Ensure integrity of building to assure weatherproofing of building contents (e.g., Tarp the roof);

ix. Secure fence and gate;

x. Any other required measurements or inspections deemed necessary by the FAA on its site, provided however, that the FAA shall not require Sponsor to disturb asbestos or lead paint for purposes of measurements or inspections unless implementation of the mitigation measures specified in Paragraphs 1.a., 1.b. or 1.c. require such disturbance.

e) TOVCC will remove the aforementioned mitigation measures, except any replacement of guy wires, at an agreed upon time.

2. TOVCC shall establish survey monuments as needed on the FAA property to determine the commencement, extent, and conclusion of longwall mining subsidence. These results will not be used as benchmarks for determining survey information, i.e. latitude, longitude, or MSL elevation.

3. TOVCC shall provide building and site elevation information in Mean Sea Level (MSL) elevations using Global Positioning System (GPS) equipment or more sophisticated equipment agreed to by the parties.

Agreement Attachment 2: Survey & Inspections

1. Pre-Mining Survey

a. Determine condition of roof. Consider any leaking, holes, seams in metal, and soffits.
b. Remove siding for ease of viewing masonry damage if masonry cannot be viewed from inside the building.*
c. Determine MSL elevations of floor slab, locations around perimeter, and inside rooms.
d. Determine MSL elevations and coordinates at tower locations.
e. Determine interior and exterior walls, corners of building, and doors are vertical, and document general condition.
f. Determine condition and output (gpm and quality) of well.*
g. Confirm clean water system, toilet, and sink are operating.*
h. Confirm septic system is functioning.*

i. Determine condition of building foundation without excavating it beyond any excavation necessary to brace building foundation as required by Attachment 1(a) and 1(d)(iii).
j. Conduct land survey within 500 feet of the building.
k. Determine integrity of unearthed cables.
l. Determine condition of incoming utility poles.
m. Determine condition of access road.
n. Determine condition of HVAC system, electrical panels, circuits, lighting, conduits and piping.
o. Determine condition of counterpoise and grounding system (facility, and multi-point systems).
p. Determine condition of site fence and gates.
q. Determine site drainage problems.
r. HAZMAT-Asbestos containing material (ACM) & Lead HAZMAT testing if removal is necessary.*
s. Determine replacement cost of building.

2. Post-Mining Inspections

a. Check building roof for leaks, holes, broken roof seams, broken gutters, and fascia.
b. Ensure integrity of building to assure weatherproofing of building contents.
c. Check building masonry structure for cracking.*
d. Determine MSL elevations of floor slab, at locations around perimeter and inside rooms. After mining, TOVCC shall provide building and site elevation information in Mean Sea Level (MSL) elevations using Global Positioning System (GPS) equipment or more sophisticated equipment agreed to by the parties at thirty (30) day increments up to one year after conclusion of mining or until both parties agree to suspend the effort.
e. Determine MSL elevations and coordinates at tower locations. After mining, TOVCC shall provide continuous building and site elevation information in Mean Sea Level (MSL) elevations using Global Positioning System (GPS) equipment or more sophisticated equipment agreed to by the parties at thirty (30) day increments up to one year after conclusion of mining or until both parties agree to suspend the effort.
f. Determine whether interior and exterior walls, corners of building, and doors match pre-subsidence condition.
g. Determine condition and output (gpm and quality) of well.*
h. Confirm clean water system, toilet, and sink remain operational.*
i. Confirm operation of septic system.*
j. Determine condition of building foundation.*
k. Determine condition of cables.
l. Determine condition of incoming utility poles.
m. Determine condition of access road.

n. Determine condition of HVAC system, electrical panels, circuits, lighting, conduits and piping.
o. Confirm operational integrity of counterpoise and grounding system (facility, and multi-point systems).
p. Determine condition of site fence and gates.
q. Inspect property for crevices, potholes, sinkholes, low spots that may cause personal injuries, or drainage problems affecting RCAG operations and facility maintenance.
r. Inspect site topography to accommodate rebuilding or reconstruction of RCAG facility if necessary.*
s. Inspect for other damages including but not limited to the above

*The asterisked surveys and inspections may require the use of a qualified third party contractor. Sponsor shall have the right to use a third party contractor to meet its obligations under the Agreement.

NON-FEDERAL REIMBURSABLE AGREEMENT

BETWEEN

**DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION**

AND

**THE OHIO VALLEY COAL COMPANY
56854 PLEASANT RIDGE ROAD
ALLEDONIA, OHIO 43902**

WHEREAS, The Ohio Valley Coal Company (Sponsor) intends to exercise its right to mine all of the No. 8 coal beneath the Federal Aviation Administration's Belmont, Ohio Remote Communication Air to Ground (RCAG) site using the full-extraction method of underground mining known as longwall mining (hereinafter "mining");

WHEREAS, the Federal Aviation Administration (FAA) has determined that Sponsor's mining may cause an interruption to the facility and pose a risk to the flying public;

WHEREAS, the FAA can furnish directly or by contract, material, supplies, equipment, and services which the Sponsor requires, has funds available for, and has determined should be obtained from the FAA;

WHEREAS, it has been determined that competition with the private sector for provision of such material, supplies, equipment, and services is minimal; the proposed activity will advance the FAA's mission; and the FAA has a unique capability that will be of benefit to the Sponsor while helping to advance the FAA's mission;

WHEREAS, the authority for the FAA to furnish material, supplies, equipment, and services to the Sponsor upon a reimbursable payment basis is found in 49 U.S.C. 106 (l)(6) on such terms and conditions as the Administrator may consider necessary;

WHEREAS, Sponsor has agreed to mitigate damages as described by Article 3, Section A of this Agreement and Attachment 1: TOVCC Pre-Mining Mitigation Measures attached hereto and made a part hereof, at the Sponsor's expense; such mitigation shall occur prior to mining within 500 feet of the fence line of the Belmont Remote Communications Air to Ground (RCAG) site, but after the FAA, at its expense and no later than April 15, 2011, has completed the work necessary to temporarily transfer the functions of the Belmont RCAG facility to facilities located outside Sponsor's mining area;

NOW THEREFORE, the FAA and the Sponsor mutually agree as follows:

ARTICLE 1. Parties

The Parties to this Agreement are the FAA and The Ohio Valley Coal Company (TOVCC,

Agreement Number
AJW-FN-CSA-11-C041

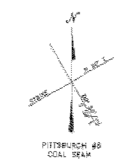
AGREED:

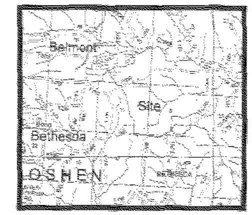
FEDERAL AVIATION ADMINISTRATION		**THE OHIO VALLEY COAL COMPANY**	
SIGNATURE	Irene Medina	SIGNATURE	Paul B Piccolini
NAME	Irene Medina	NAME	Paul B. Piccolini
TITLE	Contracting Officer	TITLE	Vice President
DATE	12/28/10	DATE	December 20, 2010

NOTES: 1. Surface, coal, and lease information shown hereon (within the shadow area) provided by the applicant.

2. The maximum overburden is 550 feet. The lowest cover overburden is 470 feet.

3. The maximum area of influence from subsidence will be 24 degrees measured out from the Panel Edge. The entire application area will be subsided as a portion of the mining within the D-0360-23 approved mining area.





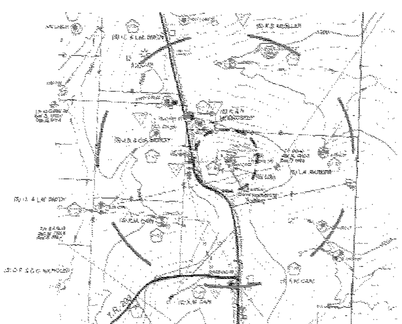
Location Map - Belmont County Highway Map
Scale: 1" = 1 Mile
Quadrangle Name: Bethesda
Drainage Basin: McMahon Creek
Mapping acquired from the Belmont County GOOT Map

SUMMARY OF ACREAGES

8.0 FULL COAL RECOVERY ACREAGE (ALSO LONGWALL MINING)
0 PARTIAL COAL RECOVERY ACREAGE (ALSO ROOM AND PILLAR MINING)
8.0 TOTAL COAL ACREAGE (SHADOW AREA)

LEGEND

- Site
- OCCUPIED DWELLING
- UNOCCUPIED DWELLING
- PUBLIC COMMUNITY INSTITUTIONAL BUILDING
- COMMERCIAL BUILDING
- CEMETERY
- ROADS INSIDE AND OUTSIDE PERMIT AREA
- PROPERTY LINE
- (A) SURFACE and NON COAL OWNER - AS SHOWN
- (C) COAL OWNER - CONSOLIDATED LAND COMPANY **
- (L) LESSEE - TOVCO **
- GAS WELL (DRY HOLE)
- EXPIRED PERMIT LOCATION
- UNKNOWN STATUS
- Producing Gas Well
- TEST BORING
- EXISTING WATER IMPOUNDMENT / POND
- PERENNIAL STREAM
- INTERMITTENT STREAM
- PROPOSED SHADOW AREA
- PARTIAL COAL RECOVERY AREA (Room & Pillar)
- 1000' HYDROLOGY LIMIT
- PRIVATE WATER SUPPLY LINE
- PUBLIC WATER
- 200 FT COVER LINE
- CISTERN
- U UPSTREAM SAMPLING STATION
- D DOWNSTREAM SAMPLING STATION
- W DRILLED WELL (NO LOG AVAILABLE)
- DW DUG WELL
- DS DEVELOPED SPRING
- S UNDEVELOPED SPRING
- P WATER IMPOUNDMENT / POND
- BACKGROUND SAMPLING STATION
- MONITORING STATION
- AERIAL POWER LINE
- UNDERGROUND TELEPHONE
- AERIAL POWER AND TELEPHONE LINE
- AERIAL TELEPHONE
- GAS LINE - COLUMBIA GAS COMPANY
- GAS METER - COLUMBIA GAS COMPANY
- PERMIT D-0360
- TOVCO THE OHIO VALLEY COAL COMPANY
- SUBSIDENCE CONTROL SURVEY NO.
- ARCHEOLOGY-UNDERGROUND NO.
- ZERO SUBSIDENCE LINE / ANGLE OF DRAW
- WETLAND



0 500 1000 1500

I, THE UNDERSIGNED, HEREBY CERTIFY THAT THIS MAP IS CORRECT, AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY CHAPTER 1513 OF THE REVISED CODE AND RULES ADOPTED THEREUNDER.

STATE OF OHIO
CHARLES E. CALDWELL
S-7189
REGISTERED
PROFESSIONAL SURVEYOR

[signature] 7109

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC THIS 3rd DAY OF February 2011

[signature]
NOTARY PUBLIC

PENNY L. ELLIOTT
Notary Public
State of Ohio
My Commission Exp.

ARPMAP

The Ohio Valley Coal Company
56854 Pleasant Ridge Road, Alledonia, Ohio 43902

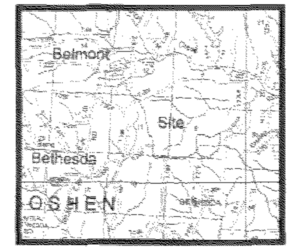
SECTION: 11	
T - 7 R - 5	TWP - Goshen
COUNTY: Belmont	CONTOUR INTERVAL: 20'
SCALE: 1" = 500'	
DATE PREPARED: July 29, 2010	
DRAWN BY: dls	

THE OHIO VALLEY COAL COMPANY

56854 Pleasant Ridge Rd
Alledonia, OH 43902
Phone: 740.926.1351
Fax: 740.926.1615

TC 20470
EM70

NOTES: 1. Surface, coal, and lease information shown hereon (within the shadow area) provided by the applicant.
2. The maximum overburden is 350 feet. The lowest cover overburden is 170 feet.
3. The maximum area of influence from subsidence will be 24 degrees measured out from the Panel Edge. The entire application area will be subsided as a portion of the mining within the D-0360-23 approved mining area.



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Scale: 1" = 1 Mile
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Mapping acquired from the Belmont County ODOT Map

SUMMARY OF ACREAGES

8.0 FULL COAL RECOVERY ACREAGE (ALSO LONGWALL MINING)
0 PARTIAL COAL RECOVERY ACREAGE (ALSO ROOM AND PILLAR MINING)
8.0 TOTAL COAL ACREAGE (SHADOW AREA)

LEGEND

- Site
- OCCUPIED DWELLING
- UNOCCUPIED DWELLING
- PUBLIC, COMMUNITY, INSTITUTIONAL BUILDING
- COMMERCIAL BUILDING
- CEMETERY
- ROADS INSIDE AND OUTSIDE PERMIT AREA
- PROPERTY LINE
- SURFACE and NON COAL OWNER - AS SHOWN
- COAL OWNER - CONSOLIDATED LAND COMPANY **
- LESSEE - TOVCC **
- GAS WELL (DRY HOLE)
- EXPIRED PERMIT LOCATION
- UNKNOWN STATUS
- Producing Gas Well
- TEST BORING
- EXISTING WATER IMPOUNDMENT / POND
- PERENNIAL STREAM
- INTERMITTENT STREAM
- PROPOSED SHADOW AREA
- PARTIAL COAL RECOVERY AREA (Room & Pillar)
- 1000' HYDROLOGY LIMIT
- PRIVATE WATER SUPPLY LINE
- PUBLIC WATER
- 200 FT COVER LINE
- CISTERN
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- D- DOWNSTREAM SAMPLING STATION
- W- DRILLED WELL (NO LOG AVAILABLE)
- DW- DUG WELL
- DS- DEVELOPED SPRING
- S- UNDEVELOPED SPRING
- P- WATER IMPOUNDMENT / POND
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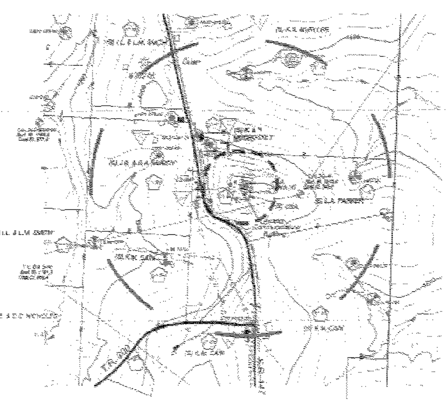
- MONITORING STATION
- AERIAL POWER LINE
- UNDERGROUND TELEPHONE
- AERIAL POWER AND TELEPHONE LINE
- AERIAL TELEPHONE
- GAS LINE - COLUMBIA GAS COMPANY
- GAS METER - COLUMBIA GAS COMPANY
- PERMIT D-0360
- "TOVCC" THE OHIO VALLEY COAL COMPANY
- SUBSIDENCE CONTROL SURVEY NO.
- ARCHEOLOGY-UNDERGROUND NO.
- ZERO SUBSIDENCE LINE / ANGLE OF DRAW
- WETLAND

0 500 1000 1500



STATE OF OHIO
CHARLES R. KALOGER
S 7186
REGISTERED
PROFESSIONAL SURVEYOR

I, THE UNDERSIGNED, HEREBY CERTIFY THAT THIS MAP IS CORRECT, AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY CHAPTER 1513 OF THE REVISED CODE AND RULES ADOPTED THEREUNDER.

Charles R. Kaloger 7186

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC THIS 3rd DAY OF February 2011

Penny J. Elliott
NOTARY PUBLIC
PENNY J. ELLIOTT
Notary Public
State of Ohio
My Commission Exp. Feb. 11, 2013

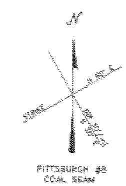
ARPMAP	
The Ohio Valley Coal Company 56854 Pleasant Ridge Road, Alledonia, Ohio, 43902	
SECTION: 11	
T - 7 R - 5	TWP. - Goshen
COUNTY: Belmont	CONTOUR INTERVAL: 20'
SCALE: 1" = 500'	
DATE PREPARED: July 22, 2010	
DRAWN BY: SD	
THE OHIO VALLEY COAL COMPANY	56854 Pleasant Ridge Rd. Alledonia, OH 43902 Phone: 740.926.1351 Fax: 740.926.1615

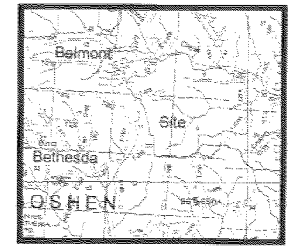
TOVCC 20471

NOTES: 1. Surface, coal, and lease information shown hereon (within the shadow area) provided by the applicant.

2. The maximum overburden is 500 feet. The lowest cover overburden is 470 feet.

3. The maximum area of influence from subsidence will be 24 degrees measured out from the Panel Edge. The entire application area will be subsided as a portion of the mining within the D-0360-23 approved mining area.





Location Map - Belmont County Highway Map
Scale: 1" = 1 Mile
Quadrangle Name: Bethesda
Drainage Basin: McMahon Creek
Mapping acquired from the Belmont County ODOT Map

SUMMARY OF ACREAGES

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__0__ PARTIAL COAL RECOVERY ACREAGE (ALSO ROOM AND PILLAR MINING)
__8.0__ TOTAL COAL ACREAGE (SHADOW AREA)

LEGEND

- 24s
- OCCUPIED DWELLING
- UNOCCUPIED DWELLING
- PUBLIC, COMMUNITY, INSTITUTIONAL BUILDING
- COMMERCIAL BUILDING
- CEMETERY
- ROADS INSIDE AND OUTSIDE PERMIT AREA
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- (S) SURFACE and NON COAL OWNER - AS SHOWN
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- GAS METER - COLUMBIA GAS COMPANY
- PERMIT D-0360
- "TOVCC" THE OHIO VALLEY COAL COMPANY
- SUBSIDENCE CONTROL SURVEY NO.
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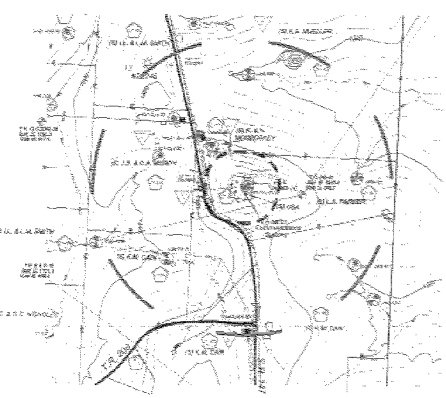


0 500 1000 1500

STATE OF OHIO
CHARLES R. KALIHER
S 7109
REGISTERED PROFESSIONAL SURVEYOR

I, THE UNDERSIGNED, HEREBY CERTIFY THAT THIS MAP IS CORRECT, AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY CHAPTER 1513 OF THE REVISED CODE AND RULES ADOPTED THEREUNDER.

Charles R. Kaliher 1/21/11

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC THIS 3rd DAY OF February 2011

Penny Elliott
NOTARY PUBLIC

PENNY A. ELLIOTT
Notary Public
State of Ohio
My Commission Exp. Feb. 11, 2013

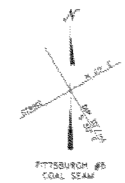
ARPMAP	
The Ohio Valley Coal Company 56854 Pleasant Ridge Road, Alledonia, Ohio 43902	
SECTION: 11	
T - 7 R - 5	TWP. - Goshen
COUNTY: Belmont	CONTOUR INTERVAL: 20'
SCALE: 1" = 500'	
DATE PREPARED: July 22, 2010	
DRAWN BY: db	

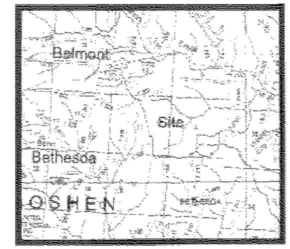
THE OHIO VALLEY COAL COMPANY

56854 Pleasant Ridge Rd.
Alledonia, OH 43902
Phone: 740 926 1351
Fax: 740 926 1615

TOVCC 20472

NOTES:
1. Surface, coal, and lease information shown hereon (within the shadow area) provided by the applicant.
2. The maximum overburden is 550 feet. The lowest cover overburden is 470 feet.
3. The maximum area of influence from subsidence will be 24 degrees measured out from the Panel Edge. The entire application area will be subsided as a portion of the mining within the D-0360-23 approved mining area.





Location Map - Belmont County Highway Map
Scale: 1" = 1 Mile
Quadrangle Name: Bethesda
Drainage Basin: McMahon Creek
Mapping acquired from the Belmont County ODOT Map

SUMMARY OF ACREAGES

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8.0 TOTAL COAL ACREAGE (SHADOW AREA)

LEGEND

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- COMMERCIAL BUILDING
- CEMETERY
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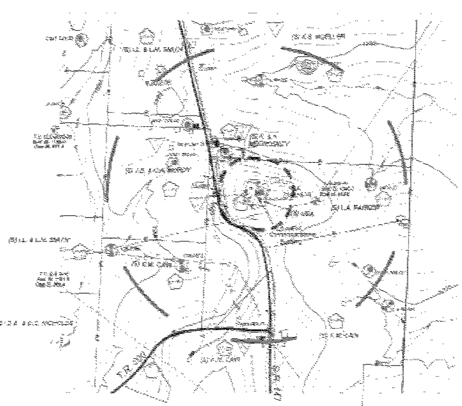

STATE OF OHIO
CHARLES R. KALAGER
S 7186
REGISTERED PROFESSIONAL SURVEYOR

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Charles R. Kalager 7186

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Penny J. Elliott
PENNY J. ELLIOTT
Notary Public
State of Ohio
My Commission Exp. Feb. 11, 2014

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COUNTY: Belmont	CONTOUR INTERVAL: 20'
SCALE: 1" = 500'	
DATE PREPARED: July 22, 2010	
DRAWN BY: dlk	

56854 Pleasant Ridge Rd
Alledonia, OH 43902
Phone: 740.926.1351
Fax: 740.926.1615

TOVCC 20473

NOTES: 1. Surface, coal, and lease information shown hereon (within the shadow area) provided by the applicant.

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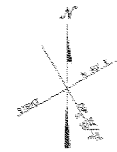

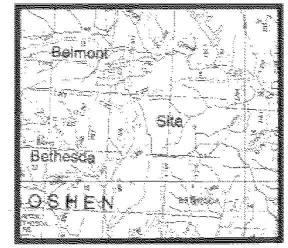

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Drainage Basin: McMahon Creek
Mapping supplied from the Belmont County ODOT Map

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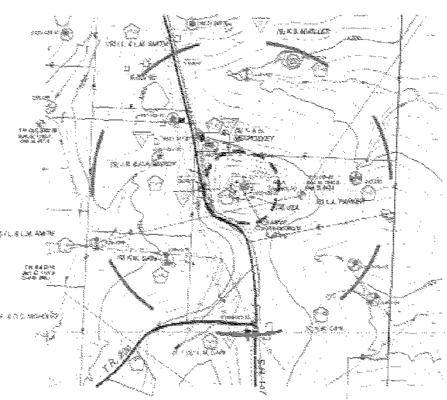

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STATE OF OHIO * CHARLES R. KALUGER * 7188 * REGISTERED * PROFESSIONAL SURVEYOR

Charles R. Kaluger 4-7188

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC THIS 3rd DAY OF February 2011

[signature]

NOTARY PUBLIC
Notary Public
State of Ohio
My Commission Exp. Feb. 11, 2013

ARPMAP	
The Ohio Valley Coal Company 56854 Pleasant Ridge Road, Alledonia, Ohio, 43902	
SECTION: 11	
T.-7 R.-5	TWP. - Goshen
COUNTY: Belmont	CONTOUR INTERVAL: 20'
SCALE: 1" = 500'	
DATE PREPARED: July 22, 2010	
DRAWN BY: dls	
	56854 Pleasant Ridge Rd Alledonia, OH 43902 Phone: 740.926.1351 Fax: 740.926.1615

________ New Submittal
________ Revised Submittal R-________

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

APPLICATION TO REVISE A COAL MINING PERMIT

Note: Refer to the division's "General Guidelines for Processing ARPs" and "Requirements for Specific Types of Common ARPs" for guidance on submitting and processing ARPs.

1. Applicant's Name **THE OHIO VALLEY COAL COMPANY**

   Address **56854 PLEASANT RIDGE ROAD**

   City **ALLEDONIA** State **OH** Zip **43902**

   Telephone Number **740-926-1351**

2. Permit Number **D-0360**

3. Section of mining and reclamation to be revised:

   PARTS 2 AND 4

4. Describe in detail the proposed revision and submit any necessary drawings, plans, maps, etc:

   THIS REVISION CHANGES THE MINING UNDER TOWERS OWNED BY THE FEDERAL AVIATION ADMINISTRATION FROM ROOM AND PILLAR MINING TO FULL COAL RECOVERY MINING

5. Describe in detail the reason for requesting the revision:

   THIS REVISION IS NEEDED TO MAKE BETTER USE OF THE RESERVE AND NOT SKIP THE LONGWALL MINING AROUND STRUCTURES THAT CAN BE PROTECTED FROM MATERIAL DAMAGE

6. Will this revision constitute a significant alteration from the mining and reclamation operations contemplated in the original permit? ☒ Yes, ☐ No.
   (**Note:** refer to paragraph (E)(2) of 1501:13-04-06 of the Ohio Administrative Code to determine if a revision is deemed significant.)

   If "yes," complete the following items 7 through 9.

7. In the space below, give the name and address of the newspaper in which the public notice is to be published.

   THE TIMES LEADER
   200 S. 4^{TH} STREET
   MARTINS FERRY, OH 43935

________ New Submittal
________ Revised Submittal R-________

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

APPLICATION TO REVISE A COAL MINING PERMIT

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   Address **56854 PLEASANT RIDGE ROAD**

   City **ALLEDONIA** State **OH** Zip **43902**

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   THE TIMES LEADER
   200 S. 4TH STREET
   MARTINS FERRY, OH 43935

Revised 03/06
DNR-744-9003

TOVCC 20476

8. In the space below, give the text of the public notice that is to be published. (Include the information required by paragraph (A)(1) of 1501:13-05-01 of the Ohio Administrative Code.)

THE OHIO VALLEY COAL COMPANY, POWHATAN NO. 6 MINE, 56854 PLEASANT RIDGE ROAD, ALLEDONIA, OH 43902 HAS SUBMITTED AN APPLICATION TO REVISE PERMIT D-0360 TO THE OHIO DEPARTMENT OF NATURAL RESOURCES, MINERAL RESOURCES MANAGEMENT. THIS APPLICATION CHANGES THE MINING UNDER 8.0 ACRES IN SECTION 11, GOSHEN TOWNSHIP (T-7, R-5), BELMONT COUNTY, OHIO FROM ROOM AND PILLAR MINING TO FULL RECOVERY (LONGWALL) MINING. THE AREA TO BE MINED MAY BE FOUND ON THE BETHESDA, OHIO 7-1/2 MIN USGS QUADRANGLE MAP. THIS AREA IS CURRENTLY APPROVED FOR PARTIAL RECOVERY MINING WITHIN THE D-0360-23 APPROVED UNDERGROUND MINING AREA. COAL IN THIS AREA WILL BE MINED USING FULL COAL RECOVERY METHODS.
THIS APPLICATION IS ON FILE AT THE RECORDER'S OFFICE, BELMONT COUNTY COURT HOUSE, 101 WEST MAIN STREET, ST. CLAIRSVILLE, OH 43950 FOR PUBLIC VIEWING. WRITTEN COMMENTS OR REQUESTS FOR AN INFORMAL CONFERENCE MAY BE SENT TO THE DIVISION OF MINERAL RESOURCES MANAGEMENT, 2045 MORSE ROAD, BUILDING H-3, COLUMBUS, OH 43229-6693 WITHIN THIRTY DAYS OF THE LAST DATE OF PUBLICATION OF THIS NOTICE.

9. In the space below, give the name and address of the public office where this application is to be filed for public viewing.

RECORDER'S OFFICE, BELMNT COUNTY COURT HOUSE, 101 W. MAIN ST, ST. CLAIRSVILLE, OHIO 43950

I, the undersigned, a responsible official of the applicant, do hereby verify the information contained in this revision request is true and correct to the best of my information and belief.

Print Name DAVID L. BARTSCH Title ENV. COORDINATOR

Signature David L. Bartsch Date 7-22-2010

Sworn before me and subscribed in my presence this 22nd day of July, 2010

Penny J. Elliott
PENNY J. ELLIOTT
Notary Public
State of Ohio
My Commission Exp. Feb. 11, 2013

TOVCC 20477

(For Division Use Only)

This application for renewal is hereby ☐ issued, ☐ disapproved.

____ _________________________

Chief, Division of Mineral Resources Management Date

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

SUBSIDENCE CONTROL – PROTECTION OF SPECIFIC STRUCTURES

Applicant's Name: **THE OHIO VALLEY COAL COMPANY**

1. List the specific structures, facilities or features to be protected and the corresponding map location key.

   FEDERAL AVIATION ADMINISTRATION (FAA) FACILITY - SEE LUO REPORT

2. Is a subsidence control plan being submitted, and does the plan demonstrate that subsidence will not cause material damage or reduce the reasonable foreseeable use of such structures, facilities or features? ☒ Yes, ☐ No

   If "yes," submit the proposed subsidence control plan.

   If "no," answer questions 3 – 7 below.

   Submit documentation the proposed subsidence control plan, or the documentation required by answering questions 3-7 below, has been provided to the public authority responsible for the protected structures, facilities or features. Submit copies of all comments received from the public authority on the required submittal or responses.

3. What is the dimension of the safety zone on the surface that extends beyond the structure to be protected? feet

4. Is the ground surface slope within the protected area greater than 14% or 8 degrees in any direction? ☐ Yes, ☐ No

   If "yes," describe the increased size of the protected area on the downslope side necessary to compensate for this slope.

5. Describe the method for determining the size of the pillar support area at mine level.

6. Indicate the maximum extraction ratio and the minimum safety factor of the coal pillars within the proposed pillar support area.

7. Indicate the long-term strength of the mine roof and the mine floor relative to the strength of the coal seam.

Ohio Department of Natural Resources

JOHN R. KASICK, GOVERNOR | DAVID MUSTINE, DIRECTOR

Division of Mineral Resources Management
John F. Husted, Chief
2045 Morse Road Building H-3
Columbus, Ohio 43229-6693
Phone: (614) 265-6633 Fax: (614) 265-7998

Date: 03/18/2011

To: Appropriate Governmental Agencies

From: John F. Husted, Chief
Division of Mineral Resources Management

Re: Coal Mine Permit Revision Number: R-0360-70
Coal Mine Permit Number: D-360
Date Issued: 03/15/2011

Summary of Revision Requested:

Revise Mining Method

Applicant: THE OHIO VALLEY COAL CO
56854 PLEASANT RIDGE ROAD
ALLEDONIA, OH 43902

Telephone: (740) 926-1351

COUNTY	TOWNSHIP	SECTION	LOTS	T	R	Quad
BELMONT	GOSHEN	11		7	5	BETHESDA

F65 Rev: 07/01/2001

TOVCC 20480

Distribution List:

Mike Kosek
Division of Mineral Resources Management
2050 East Wheeling Avenue
Cambridge, OH 43725

Belmont County Commissioners
Courthouse
Main Street
St. Clairsville, OH 43950

Belmont County Planning Commission
Courthouse
Main Street
St. Clairsville, OH 43950

Goshen Township Trustees
c/o Teresa Schafer, Fiscal Officer
115 Liberty Lane
Bethesda, OH 43719

F65 Rev: 07/01/2001

COAL MINING AND RECLAMATION PERMIT
APPLICATION TO REVISE A PERMIT (ARP)

Issued To: THE OHIO VALLEY COAL CO
56854 PLEASANT RIDGE ROAD
ALLEDONIA, OH 43902

Telephone: (740) 926-1351

Permit Number: D-360
Application Number: R-360-70

Effective: 03/15/2011
Expires: 06/19/2014

ARP Type:
Revise Mining Method

The issuance of this ARP means only that the application to conduct a coal mining operation meets the requirements of Chapter 1513 of the Revised Code, and as such DOES NOT RELIEVE the operator of any obligation to meet other federal, state or local requirements.

This ARP is issued in accordance with and subject to the provisions, conditions, and limitations of Chapter 1513 of the Revised Code and Chapters 1501:13-1, 1501:13-3 through 1501:13-14 of the Administrative Code.

The approved water monitoring plan for this ARP is:

Quality: N/A
Quantity: N/A

Note: Any previous condition(s) imposed on this permit, or subsequent adjacent areas, also apply to this ARP unless noted otherwise.

Signature: John F. Hoertz
Chief, Mineral Resources Management

Date: 03/15/2011

OPERATOR

F100 Rev: 07/01/2001

TOVCC 20482

_____ New Submittal
__X__ Revised Submittal R- 0360-70

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

APPLICATION TO REVISE A COAL MINING PERMIT

Note: Refer to the division's "General Guidelines for Processing ARPs" and "Requirements for Specific Types of Common ARPs" for guidance on submitting and processing ARPs.

1. Applicant's Name THE OHIO VALLEY COAL COMPANY
   Address 56854 PLEASANT RIDGE ROAD
   City ALLEDONIA State OH Zip 43902
   Telephone Number 740-926-1351
2. Permit Number D-0360
3. Section of mining and reclamation to be revised:
   PART 4 SUBSIDENCE CONTROL PLAN
4. Describe in detail the proposed revision and submit any necessary drawings, plans, maps, etc:

   THIS REVISION CHANGES THE MINING UNDER TOWERS OWNED BY THE FEDERAL AVIATION ADMINISTRATION FROM ROOM AND PILLAR MINING TO FULL COAL RECOVERY MINING
5. Describe in detail the reason for requesting the revision:

   THIS REVISION IS NEEDED TO MAKE BETTER USE OF THE RESERVE AND NOT SKIP THE LONGWALL MINING AROUND STRUCTURES THAT CAN BE PROTECTED FROM MATERIAL DAMAGE AND THAT THE REASONABLE FORSEEABLE USE OF THE FACILITY WILL BE PROTECTED
6. Will this revision constitute a significant alteration from the mining and reclamation operations contemplated in the original permit? ☒ Yes, ☐ No.
   (Note: refer to paragraph (E)(2) of 1501:13-04-06 of the Ohio Administrative Code to determine if a revision is deemed significant.)

   If "yes," complete the following items 7 through 9.
7. In the space below, give the name and address of the newspaper in which the public notice is to be published.

   THE TIMES LEADER
   200 S. 4TH STREET
   MARTINS FERRY, OH 43935

MAR 08 2011

D-0360-70 OPERATOR

TOVCC 20483

8. In the space below, give the text of the public notice that is to be published. (Include the information required by paragraph (A)(1) of 1501:13-05-01 of the Ohio Administrative Code.)

THE OHIO VALLEY COAL COMPANY, POWHATAN NO. 6 MINE, 56854 PLEASANT RIDGE ROAD, ALLEDONIA, OH 43902 HAS SUBMITTED AN APPLICATION TO REVISE PERMIT D-0360 TO THE OHIO DEPARTMENT OF NATURAL RESOURCES, MINERAL RESOURCES MANAGEMENT. THIS APPLICATION CHANGES THE MINING UNDER 8.0 ACRES IN SECTION 11, GOSHEN TOWNSHIP (T-7, R-5), BELMONT COUNTY, OHIO FROM ROOM AND PILLAR MINING TO FULL RECOVERY (LONGWALL) MINING. THE AREA TO BE MINED MAY BE FOUND ON THE BETHESDA, OHIO 7-1/2 MIN USGS QUADRANGLE MAP. THIS AREA IS CURRENTLY APPROVED FOR PARTIAL RECOVERY MINING WITHIN THE D-0360-23 APPROVED UNDERGROUND MINING AREA. COAL IN THIS AREA WILL BE MINED USING FULL COAL RECOVERY METHODS.
THIS APPLICATION IS ON FILE AT THE RECORDER'S OFFICE, BELMONT COUNTY COURT HOUSE, 101 WEST MAIN STREET, ST. CLAIRSVILLE, OH 43950 FOR PUBLIC VIEWING. WRITTEN COMMENTS OR REQUESTS FOR AN INFORMAL CONFERENCE MAY BE SENT TO THE DIVISION OF MINERAL RESOURCES MANAGEMENT, 2045 MORSE ROAD, BUILDING H-3, COLUMBUS, OH 43229-6693 WITHIN THIRTY DAYS OF THE LAST DATE OF PUBLICATION OF THIS NOTICE.

9. In the space below, give the name and address of the public office where this application is to be filed for public viewing.

RECORDER'S OFFICE, BELMNT COUNTY COURT HOUSE, 101 W. MAIN ST, ST. CLAIRSVILLE, OHIO 43950

I, the undersigned, a responsible official of the applicant, do hereby verify the information contained in this revision request is true and correct to the best of my information and belief.

Print Name DAVID L. BARTSCH Title ENV. COORDINATOR

Signature David L Bartsch Date 7-22-2010

Sworn before me and subscribed in my presence this 22nd day of July, 2010

Penny J Elliott
PENNY J. ELLIOTT
Notary Public
State of Ohio
My Commission Exp. Feb. 11, 2013

NOTARY PUBLIC STATE OF OHIO

TOVCC 20484

PROOF OF PUBLICATION

The State of Ohio
County of Belmont, ss:

The undersigned, being sworn, says that he or she is an employee of Eastern Ohio Newspapers, Inc., A Corporation, publisher of the Times Leader a newspaper published in Martins Ferry, Belmont County, Ohio, each day of the week and of general circulation in said city and county; that it is a newspaper meeting the requirements of sections 7.12 and 5721.01 Ohio Revised Code as amended effective September 24, 1957; that affiant has custody of the records and files of said newspaper; and that the advertisement of which the annexed is a true copy, was published in said newspaper on each of the days in the month and year stated, as follows:

August 19, 26, September 2, 9 2010

Candace D Criswell

Subscribed by Affiant and sworn to before me, this 9th day of September A.D. 2010.

Rebecca L Anderson
Notary Public

NOTARIAL SEAL
STATE OF OHIO

REBECCA L. ANDERSON
Notary Public, State of Ohio
My Commission Expires Nov. 25, 2011

Printer's Fee $ 256.60

Notary's Fee $ ______

The Times Leader
Martins Ferry, Ohio

RECEIVED
MAR 15 2011
Division of Mineral Resources Management

The Ohio Valley Coal Company, Powhatan No. 6 Mine, 56854 Pleasant Ridge Road, Alledonia, OH 43902 has submitted an application to revise permit D-0360 to the Ohio Department of Natural Resources, Mineral Resources Management. This application changes the mining under 8.0 acres in Section 11, Goshen Township (T-7, R-5), Belmont County, Ohio from Room and Pillar Mining to Full Recovery (Longwall) Mining. The area to be mined may be found on the Bethesda, Ohio 7-½ min USGS Quadrangle Map. This area is currently approved for partial recovery mining within the D-0360-23 approved underground mining area. Coal in this area will be mined using full coal recovery methods.

This application is on file at the Recorder's Office, Belmont County Court House, 101 West Main Street, St. Clairsville, OH 43950 for public viewing. Written comments or requests for an informal conference may be sent to the Division of Mineral Resources Management, 2045 Morse Road, Building H-3, Columbus, OH 43229-6693 within thirty days of the last date of publication of this notice.

TL Adv. - 4 Thurs. - Aug. 19, 26, Sept. 2, 9

TOVCC 20485

(For Division Use Only)

This application for renewal is hereby ☑ issued, ☐ disapproved.

John F [signature]

Chief, Division of Mineral Resources Management

3-15-11

Date

TOVCC 20486

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINERAL RESOURCES MANAGEMENT

SUBSIDENCE CONTROL – PROTECTION OF SPECIFIC STRUCTURES

Applicant's Name: **THE OHIO VALLEY COAL COMPANY**

1. List the specific structures, facilities or features to be protected and the corresponding map location key.

   FEDERAL AVIATION ADMINISTRATION (FAA) FACILITY - SEE LUO REPORT

2. Is a subsidence control plan being submitted, and does the plan demonstrate that subsidence will not cause material damage or reduce the reasonable foreseeable use of such structures, facilities or features? ☒ Yes, ☐ No

   If "yes," submit the proposed subsidence control plan.

   If "no," answer questions 3 – 7 below.

   Submit documentation the proposed subsidence control plan, or the documentation required by answering questions 3-7 below, has been provided to the public authority responsible for the protected structures, facilities or features. Submit copies of all comments received from the public authority on the required submittal or responses.

3. What is the dimension of the safety zone on the surface that extends beyond the structure to be protected? feet

4. Is the ground surface slope within the protected area greater than 14% or 8 degrees in any direction? ☐ Yes, ☐ No

   If "yes," describe the increased size of the protected area on the downslope side necessary to compensate for this slope.

5. Describe the method for determining the size of the pillar support area at mine level.

6. Indicate the maximum extraction ratio and the minimum safety factor of the coal pillars within the proposed pillar support area.

7. Indicate the long-term strength of the mine roof and the mine floor relative to the strength of the coal seam.

THE OHIO VALLEY COAL COMPANY
POWHATAN NO. 6 MINE
PERMIT D-0360
ADDENDUM TO SUBSIDENCE CONTROL – PROTECTION OF SPECIFIC STRUCTURES – ITEM 2

SUBSIDENCE CONTROL PLAN

OVCC reached agreement with the Federal Aviation Administration ("FAA") on measures to protect the FAA's Belmont RCAG site from longwall subsidence damage and to safeguard the flying public during undermining. The portions of the agreement relevant to the subsidence control plan are reprinted and incorporated as a part of this addendum.

In addition, pursuant to section C.7 of OVCC's agreement with the FAA, OVCC commits to repair damages to the Belmont RCAG site resulting from OVCC's longwall mining even if such damage arises after the term of OVCC's agreement with the FAA.

U.S. Department
of Transportation

Federal Aviation
Administration

Great Lakes Region
Regional Counsel, AGL-7M
2300 East Devon Avenue
Des Plaines, Illinois 60018

T (847) 294-7313
F (847) 294-7498

Regular Mail & Facsimile (614) 265-7998

December 29, 2010

John F. Husted, Chief
Ohio Department of Natural Resources.
Division of Mineral Resources Management
2045 Morse Road, Bldg. H-3
Columbus, OH 43229-6693

Re: Permit Application Number D-360-23

Dear Mr. Husted:

The Federal Aviation Administration (FAA) and The Ohio Valley Coal Company (TOVCC) have reached agreements to assure that pre-mining mitigation measures to prevent material damage to structures and facilities will be implemented, that FAA operations at the Belmont RCAG site will be temporarily relocated at the FAA's expense prior to mining, and that the cost of any damage caused by TOVCC's mining notwithstanding the mitigation measures will be fully paid by TOVCC pursuant to the parties' agreement. Assuming compliance with the parties' agreement, the FAA does not object to TOVCC's mining beneath the Belmont RCAG.

If you have any questions, please contact Jeanette Daubaras or Briana Martino at (847) 294-7313.

Sincerely,

Briana Martino

Briana Martino
Federal Aviation Administration Attorney

cc: R. Scott Stiteler, ODNR, Scott.Stiteler@dnr.state.oh.us
B. Heavilin, ODNR, Brent.Heavilin@dnr.state.oh.us
M. Stemm, TOVCC Counsel, MStemm@porterwright.com
J. Witt, TOVCC Counsel, jwitt@coalsource.com

SUBSIDENCE CONTROL PROVISIONS EXCERPTED FROM:

NON-FEDERAL REIMBURSABLE AGREEMENT

BETWEEN

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

AND

THE OHIO VALLEY COAL COMPANY
56854 PLEASANT RIDGE ROAD
ALLEDONIA, OHIO 43902

A. This Agreement assures the FAA and the public that FAA operations will not be interrupted by mining. The advance funding of this Agreement between the FAA and the Sponsor and Article 3, Section C.7 ensure that funding will be in place to remedy any damages caused by mining to the FAA's Belmont RCAG facility in Belmont County, Ohio in the event pre-mining mitigation measures, documented in Attachment 1: TOVCC Pre-Mining Mitigation Measures, implemented at the Sponsor's expense, outside the scope of this Agreement, do not prevent all damages. This Agreement provides funding for the FAA to establish these services. With this in mind, this project is titled:

Mitigation & Repair of Damage from Mining Beneath Belmont RCAG

The Sponsor shall not conduct mining within 500 feet of the fence line of the FAA's Belmont RCAG site until the FAA has completed the work necessary to temporarily transfer the functions of the Belmont RCAG facility to facilities located outside Sponsor's mining area.

The terms and conditions outlined in this Agreement are based upon the Sponsor beginning mining operations under the Belmont facility within one (1) year of execution of this Agreement.

B. The FAA will perform the following activities:

1. Within three days after the execution of this Agreement, the FAA shall communicate in writing to the Chief of the Ohio Department of Natural Resources (ODNR), Division of Mineral Resources Management (DMRM) that the FAA and the Sponsor have reached agreements to assure that pre-mining mitigation measures to prevent material damage to structures and

facilities will be implemented, that FAA operations at the Belmont RCAG site will be temporarily relocated at the FAA's expense prior to mining, and that the cost of any damage caused by the Sponsor's mining notwithstanding the mitigation measures will be fully paid by Sponsor pursuant to this Reimbursable Agreement. The FAA shall further state in its written communication to DMRM that the FAA does not object to the Sponsor's mining beneath the Belmont RCAG.

2. No later than April 15, 2011, the FAA at its expense shall complete the work necessary to temporarily transfer the functions of the Belmont RCAG facility to facilities located outside Sponsor's mining area during Sponsor's undermining of the Belmont RCAG facility.

3. The FAA shall grant Sponsor and its employees and contractors access to the Belmont RCAG site when and to the extent required to implement the pre-mining mitigation measures described in Attachment 1 and to conduct any pre-mining surveys or post mining inspections.

4. The FAA, jointly with the Sponsor, shall conduct a pre-mining survey of the Belmont RCAG site to document its condition before Sponsor implements the mitigation efforts outlined in Attachment 1: TOVCC Pre-Mining Mitigation Measures and before Sponsor begins mining beneath the site. Such survey shall, at a minimum, include those requirements outlined by Attachment 2: Survey & Inspections.

5. The FAA shall conduct post-mining inspections of the Belmont RCAG site to assess and document the site's condition after undermining. Such inspections shall, at a minimum, include those requirements outlined by Attachment 2: Survey & Inspections. The FAA shall provide notice to Sponsor of the time and date of the FAA's inspections and permit Sponsor to conduct post-mining inspections simultaneously pursuant to Article 3, Section C.6 of this Article.

6. The FAA shall conduct its post-mining inspections of the Belmont RCAG site according to the following approximate schedule:
    a. At the time the undermining has progressed to 700 feet beyond the fence line of the facility;
    b. Thirty (30) calendar days after the first post-mining inspection;
    c. Sixty (60) calendar days after the first post-mining inspection;
    d. Ninety (90) calendar days after the first post-mining inspection; and
    e. Three Hundred Sixty (360) calendar days after the first post-mining inspection.

7. Within ten (10) business days of each of the FAA's post-mining inspections, the FAA shall itemize for Sponsor, in writing, the subsidence damages it determined require repair.

8. Within thirty (30) calendar days of each of the FAA's post-mining

inspections, the FAA shall notify Sponsor of the estimated repair cost for each damaged item identified pursuant to each of the post-mining inspections and provide the documents supporting the estimate. If replacement cost is less than repair cost, the FAA shall proceed with the lesser replacement cost.

9. The FAA shall secure contracts to repair damages identified by each of the post-mining inspections. These contracts shall be funded by the Sponsor in accordance with the terms of this Reimbursable Agreement.

10. If no further subsidence or damage is reported by the FAA's third post-mining inspection, as outlined in Article 3, Section B.6, the FAA shall release to the Sponsor within sixty (60) days eighty percent (80%) of the amount of escrowed funds in excess of the amount of the estimated repair cost documented by the FAA's prior post-mining inspections pursuant to Article 3, Section B8.

11. If no further subsidence or damage is reported by the FAA's fifth post-mining inspection, occurring three hundred sixty (360) days after the first post-mining inspection as outlined in Article 3, Section B.6, the FAA shall release to Sponsor the remaining amount of escrowed funds within sixty (60) days.

12. The FAA shall determine the completion of the terms and conditions of this Reimbursable Agreement.

C. The Sponsor will perform the following activities:

1. The Sponsor shall withdraw its Notice of Appeal from a decision of the Division Chief relating to the mining plan addressed under adjacent area application D-360-23, filed on August 30, 2010, within three days of the execution of this Reimbursable Agreement.

2. The Sponsor, jointly with the FAA, shall conduct a pre-mining survey, in accordance with Article 3, Section B4 and Attachment 1: TOVCC Pre-Mining Mitigation Measures, of the Belmont RCAG site to document its condition before undermining.

3. The Sponsor shall provide to the FAA monthly reports of current progress and mining location beginning with the execution of this Agreement.

4. The Sponsor shall report to the FAA when the proximity of mining is within 500 feet of the fence line of the facility, and thereafter provide daily progress reports from this point until such time that mining progresses 700 feet beyond the fence line of the Belmont RCAG site.

5. The Sponsor shall conduct, at the Sponsor's expense, the mitigation efforts outlined in Attachment 1: TOVCC Pre-Mining Mitigation Measures after the FAA completes the work described in Article 3, Section B2 , with Sponsor completing its mitigation efforts prior to mining within 500 feet of the fence line of the facility.

6. The Sponsor may conduct post-mining inspections of the Belmont RCAG site to document its condition after mining under the site. Sponsor may conduct

post-mining inspections to coincide with each inspection conducted by the FAA. Repairs necessary due to mining damage to the site shall be determined at the discretion of the FAA and funded by the Sponsor through the terms of this Agreement. Repair of off-site damage outside the boundaries of FAA property shall be funded by the Sponsor through the terms of this Agreement only if the damage to such off-site areas threatens the operational capability of the Belmont RCAG facility as determined by the FAA. The boundaries of the FAA property include the access road from main highway to the FAA facility.

7. Upon execution of this Agreement, the Sponsor shall submit to the ODNR a revision to their permit indicating their willingness to repair damages to the Belmont RCAG site resulting from Sponsor's mining, including any damage discovered after this Agreement has been terminated.

8. In accordance with Article 9, the Sponsor shall provide additional funding to repair damages caused to the Belmont RCAG site resulting from Sponsor's mining within forty-eight (48) hours of notification by the FAA if the amount held in escrow is insufficient to cover the estimated cost of repairs.

Agreement Attachment 1: TOVCC Pre-Mining Mitigation Measures

1. After the FAA has completed the work necessary to temporarily transfer the functions of the Belmont RCAG facility to other facilities located outside Sponsor's mining area and before mining has reached within 500 feet of the fence line of the Belmont RCAG site, Sponsor, at its expense outside the scope of the funding provided by this Agreement, shall implement:

a) the pre-mining mitigation measures recommended by Dr. Luo in his report dated June 8, 2010 (copy attached as Exhibit A);

b) the bracing recommended by Joseph "Nick" Kozak in his Affidavit dated July 20, 2010 to reinforce the equipment racks (copy attached as Exhibit B); and

c) Tri-County Tower Company's recommended replacement of any guy wires in poor condition and inspection of anchor points.

d) To the extent not implemented by the aforementioned mitigation measures, Sponsor shall also implement the following:

i. Mitigation Measures as described in Dr. Luo's report.
ii. Brace tower structures using Dr. Luo's methods;
iii. Brace building foundation;
iv. Expose buried cables from antennas or towers to control building;

v. Brace or secure equipment (TELCO responder cabinet, radio racks, power system, water pump/tank, exterior RF junction boxes, etc.);

vi. Ensure incoming utilities and poles are adequately protected to assure continuing utility service to the site;

vii. Secure HVAC, conduits, and piping;

viii. Ensure integrity of building to assure weatherproofing of building contents (e.g., Tarp the roof);

ix. Secure fence and gate;

x. Any other required measurements or inspections deemed necessary by the FAA on its site, provided however, that the FAA shall not require Sponsor to disturb asbestos or lead paint for purposes of measurements or inspections unless implementation of the mitigation measures specified in Paragraphs 1.a., 1.b. or 1.c. require such disturbance.

e) TOVCC will remove the aforementioned mitigation measures, except any replacement of guy wires, at an agreed upon time.

2. TOVCC shall establish survey monuments as needed on the FAA property to determine the commencement, extent, and conclusion of longwall mining subsidence. These results will not be used as benchmarks for determining survey information, i.e. latitude, longitude, or MSL elevation.

3. TOVCC shall provide building and site elevation information in Mean Sea Level (MSL) elevations using Global Positioning System (GPS) equipment or more sophisticated equipment agreed to by the parties.

Agreement Attachment 2: Survey & Inspections

1. Pre-Mining Survey

a. Determine condition of roof. Consider any leaking, holes, seams in metal, and soffits.
b. Remove siding for ease of viewing masonry damage if masonry cannot be viewed from inside the building.*
c. Determine MSL elevations of floor slab, locations around perimeter, and inside rooms.
d. Determine MSL elevations and coordinates at tower locations.
e. Determine interior and exterior walls, corners of building, and doors are vertical, and document general condition.
f. Determine condition and output (gpm and quality) of well.*
g. Confirm clean water system, toilet, and sink are operating.*
h. Confirm septic system is functioning.*

i. Determine condition of building foundation without excavating it beyond any excavation necessary to brace building foundation as required by Attachment 1(a) and 1(d)(iii).
j. Conduct land survey within 500 feet of the building.
k. Determine integrity of unearthed cables.
l. Determine condition of incoming utility poles.
m. Determine condition of access road.
n. Determine condition of HVAC system, electrical panels, circuits, lighting, conduits and piping.
o. Determine condition of counterpoise and grounding system (facility, and multi-point systems).
p. Determine condition of site fence and gates.
q. Determine site drainage problems.
r. HAZMAT-Asbestos containing material (ACM) & Lead HAZMAT testing if removal is necessary.*
s. Determine replacement cost of building.

2. Post-Mining Inspections

a. Check building roof for leaks, holes, broken roof seams, broken gutters, and fascia.
b. Ensure integrity of building to assure weatherproofing of building contents.
c. Check building masonry structure for cracking.*
d. Determine MSL elevations of floor slab, at locations around perimeter and inside rooms. After mining, TOVCC shall provide building and site elevation information in Mean Sea Level (MSL) elevations using Global Positioning System (GPS) equipment or more sophisticated equipment agreed to by the parties at thirty (30) day increments up to one year after conclusion of mining or until both parties agree to suspend the effort.
e. Determine MSL elevations and coordinates at tower locations. After mining, TOVCC shall provide continuous building and site elevation information in Mean Sea Level (MSL) elevations using Global Positioning System (GPS) equipment or more sophisticated equipment agreed to by the parties at thirty (30) day increments up to one year after conclusion of mining or until both parties agree to suspend the effort.
f. Determine whether interior and exterior walls, corners of building, and doors match pre-subsidence condition.
g. Determine condition and output (gpm and quality) of well.*
h. Confirm clean water system, toilet, and sink remain operational.*
i. Confirm operation of septic system.*
j. Determine condition of building foundation.*
k. Determine condition of cables.
l. Determine condition of incoming utility poles.
m. Determine condition of access road.

n. Determine condition of HVAC system, electrical panels, circuits, lighting, conduits and piping.
o. Confirm operational integrity of counterpoise and grounding system (facility, and multi-point systems).
p. Determine condition of site fence and gates.
q. Inspect property for crevices, potholes, sinkholes, low spots that may cause personal injuries, or drainage problems affecting RCAG operations and facility maintenance.
r. Inspect site topography to accommodate rebuilding or reconstruction of RCAG facility if necessary.*
s. Inspect for other damages including but not limited to the above

*The asterisked surveys and inspections may require the use of a qualified third party contractor. Sponsor shall have the right to use a third party contractor to meet its obligations under the Agreement.

Agreement Number
AJW-FN-CSA-11-C041

NON-FEDERAL REIMBURSABLE AGREEMENT

BETWEEN

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

AND

THE OHIO VALLEY COAL COMPANY
56854 PLEASANT RIDGE ROAD
ALLEDONIA, OHIO 43902

WHEREAS, The Ohio Valley Coal Company (Sponsor) intends to exercise its right to mine all of the No. 8 coal beneath the Federal Aviation Administration's Belmont, Ohio Remote Communication Air to Ground (RCAG) site using the full-extraction method of underground mining known as longwall mining (hereinafter "mining");

WHEREAS, the Federal Aviation Administration (FAA) has determined that Sponsor's mining may cause an interruption to the facility and pose a risk to the flying public;

WHEREAS, the FAA can furnish directly or by contract, material, supplies, equipment, and services which the Sponsor requires, has funds available for, and has determined should be obtained from the FAA;

WHEREAS, it has been determined that competition with the private sector for provision of such material, supplies, equipment, and services is minimal; the proposed activity will advance the FAA's mission; and the FAA has a unique capability that will be of benefit to the Sponsor while helping to advance the FAA's mission;

WHEREAS, the authority for the FAA to furnish material, supplies, equipment, and services to the Sponsor upon a reimbursable payment basis is found in 49 U.S.C. 106 (l)(6) on such terms and conditions as the Administrator may consider necessary;

WHEREAS, Sponsor has agreed to mitigate damages as described by Article 3, Section A of this Agreement and Attachment 1: TOVCC Pre-Mining Mitigation Measures attached hereto and made a part hereof, at the Sponsor's expense; such mitigation shall occur prior to mining within 500 feet of the fence line of the Belmont Remote Communications Air to Ground (RCAG) site, but after the FAA, at its expense and no later than April 15, 2011, has completed the work necessary to temporarily transfer the functions of the Belmont RCAG facility to facilities located outside Sponsor's mining area;

NOW THEREFORE, the FAA and the Sponsor mutually agree as follows:

ARTICLE 1. Parties

The Parties to this Agreement are the FAA and The Ohio Valley Coal Company (TOVCC,

Agreement Number
AJW-FN-CSA-11-C041

AGREED:

FEDERAL AVIATION ADMINISTRATION	THE OHIO VALLEY COAL COMPANY
SIGNATURE Irene Medina	SIGNATURE Paul B Piccolini
NAME Irene Medina	NAME Paul B. Piccolini
TITLE Contracting Officer	TITLE Vice President
DATE 12/28/10	DATE December 20, 2010

THE OHIO VALLEY COAL COMPANY
POWHATAN NO. 6 MINE
PERMIT D-0360
ADDENDUM TO SUBSIDENCE CONTROL – PROTECTION OF SPECIFIC STRUCTURES

SUBSIDENCE CONTROL PLAN

Dr. Luo revised his mitigation plan upon learning that the control building at the RCAG site was of different construction. Attached is his recommendation for the mitigation for the building and constitutes what will be done in addition to the recommendations in the original report.

Assessment of Subsidence Influences and Recommended Mitigation Measures for FAA Belmont Station, Belmont, OH

A Report

Submitted to

The Ohio Valley Coal Company

by

Yi Luo, *Ph.D., P.E, Associate Professor*

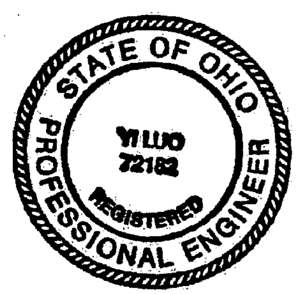
Department of Mining Engineering
College of Engineering and Mineral Resources
West Virginia University

June 8, 2010

I attest that the methodology and findings presented in this report are based upon the currently accepted principles of mining engineering. Specifically, the subsidence prediction and modeling methods used in the report have been developed and calibrated through years of research and applications on similar structures.

Yi Luo, Ph.D., P.E.
Associate Professor
Department of Mining Engineering
College of Engineering and Mineral Resources
West Virginia University
Morgantown, WV 26506

Signature:________________________ June 8, 2010



Registration No. and Seal: OH 72182

TOVCC 20501

TABLE OF CONTENTS

INTRODUCTION

The Ohio Valley Coal Company wishes to longwall mine the Pittsburgh coal seam beneath a Radio Communication Air to Ground (RCAG) site owned by the Federal Aviation Administration (FAA) in Belmont County, OH. The RCAG installation sits inside a fenced area measuring 200' by 200'. The main structures located within the fenced property are an unmanned equipment building, four guyed 60' towers, buried cables between the equipment building and the towers. The FAA has expressed concern that the planned and predictable subsidence associated with longwall mining will affect the structural integrity and functionality of the station, and in doing so, potentially impede radio communications between the FAA Cleveland Air Traffic Controller and aircraft passing over Belmont County. To address these concerns, this report presents the results of an analysis of the planned subsidence on the stability, structural integrity and functionality of the structures at the RCAG site and recommends mitigation measures to assure uninterrupted operations and prevent material damage.

LONGWALL PANEL AND THE STRUCTURES

The Longwall Panel

The portion of the longwall panel over which the property is located is shown in Fig. 1. The longwall panel is 1,168 ft (rib-to-rib) and the mining height in the Pittsburgh coal seam is about 6.25 ft based on past mining experience. The headentry of the panel is on the north side (upper side in the figure). The mining direction in the panel is from west to east (left to right in the figure).

The surface topography in the area is also plotted in Fig. 1 as well as shown in a 3-D surface image generated from Google Earth. It shows that the property is located in a relatively flat area on the top of a gentle hill. The surface elevation at the equipment building is 1,385 ft while the overburden depth at this location is about 548 ft. The variation of elevation within the fenced property is only a few feet.

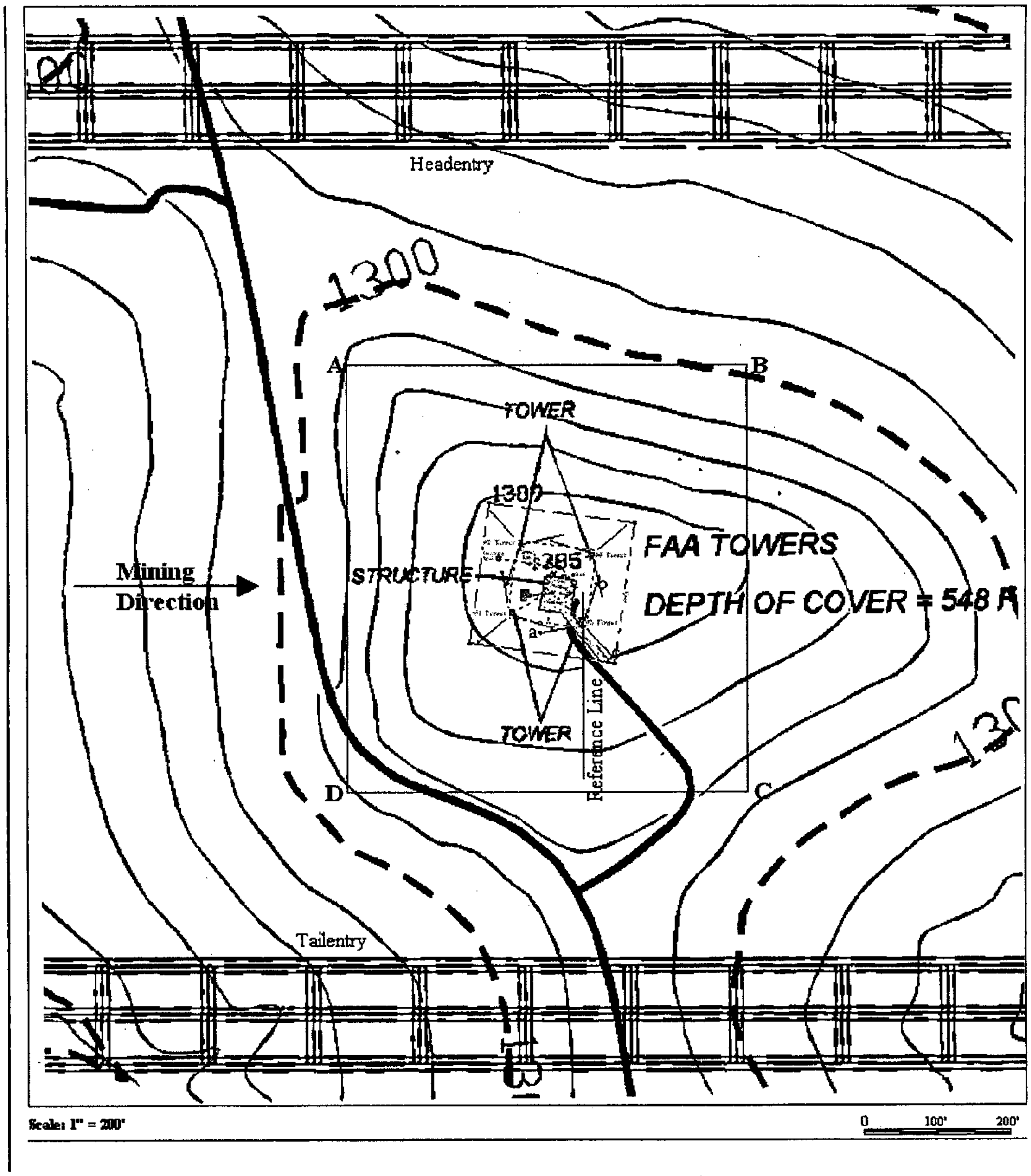


Fig. 1 Overview of the Subsidence Study Site

TOVCC 20504

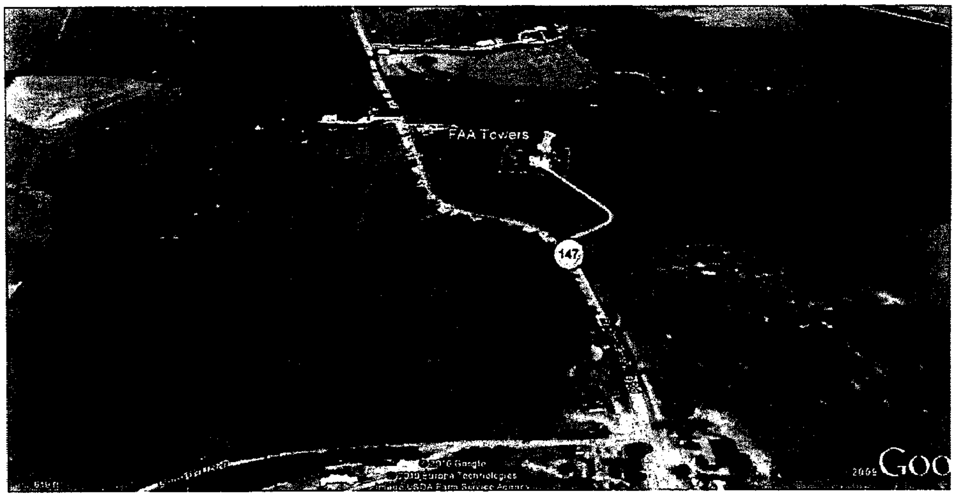


Fig. 2 Surface Topography of the Study Site (Google Earth Image)

To minimize subsidence effects during mining and to avoid any permanent subsidence influences to the structures after mining, Ohio Valley Coal purposely laid out the longwall panel so that the RCAG site would be located over the central portion of the panel. The shortest distance between the panel edge and the property fence is 430 ft.

Main Structures

The fenced property is a square area with its side length being 200 ft as shown in Figs. 3 and 4. The three main structures inside the property to perform the air to ground communication functions are:

- The *equipment building* is a rectangular, one-story and wood frame structure (Figs. 5 and 6). Based on the provided design materials, the equipment building is 44 ft wide and 18 ft deep. It is divided into an equipment room (32 ft wide) and a smaller engine/generator room (10 ft wide). It has a 12-inch thick concrete slab floor. There is no basement or crawl space under the structure according to plans provided by the FAA and statements by FAA representatives at the site.
- The *four guyed steel lattice towers*, are numbered as #1, #2, #3 and #4 according to the order to be mined under, and are laid in a square pattern as shown in Fig. 3.

The horizontal distance of each side is 100 ft. Each of the guyed towers has a 60-ft tall triangular shaped steel lattice structure (Figs. 7 and 8) with six guy wires (Φ = 3/8") tied, with adjustable turnbuckle, to three anchors (Fig. 9) located 60-ft away from its base. The lattice structure is tied to its concrete base with 3 sets of bolts/nuts (Figs. 8 and 10). The guy wires form three vertical planes with the tower and the three planes are spaced 120 degrees apart from each other. On each vertical plane, two guy wires are tied to the tower lattice structure at 30 and 60 ft above tower base, respectively. The orientations of the guy wire planes for the four towers are laid in a way that the guy wires will not cross each other but also reduce the space required as shown in Fig. 3. The mining direction forms a small angle with the long axis of the equipment building (Fig. 3).

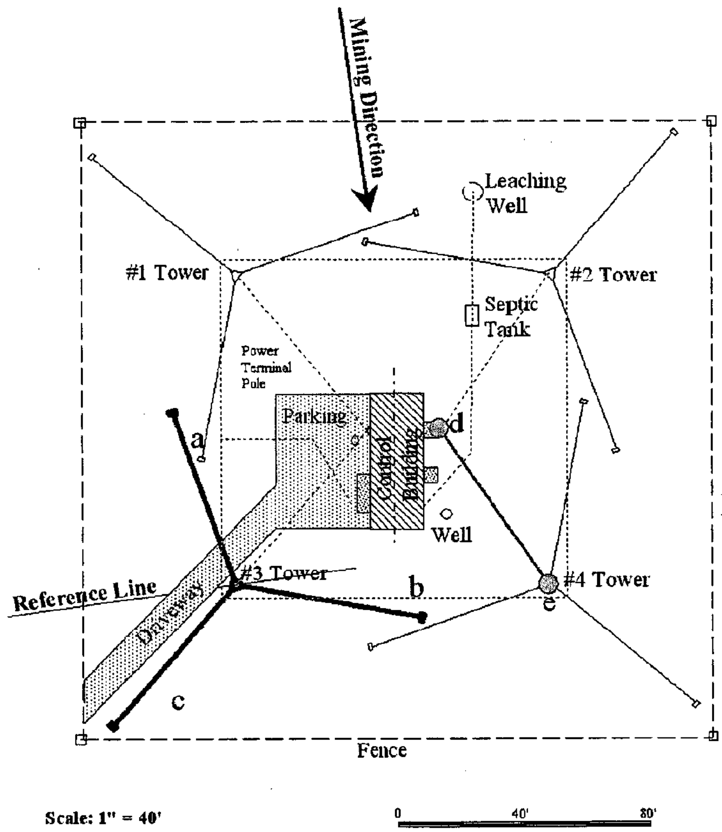


Fig. 3 Structures within the Property

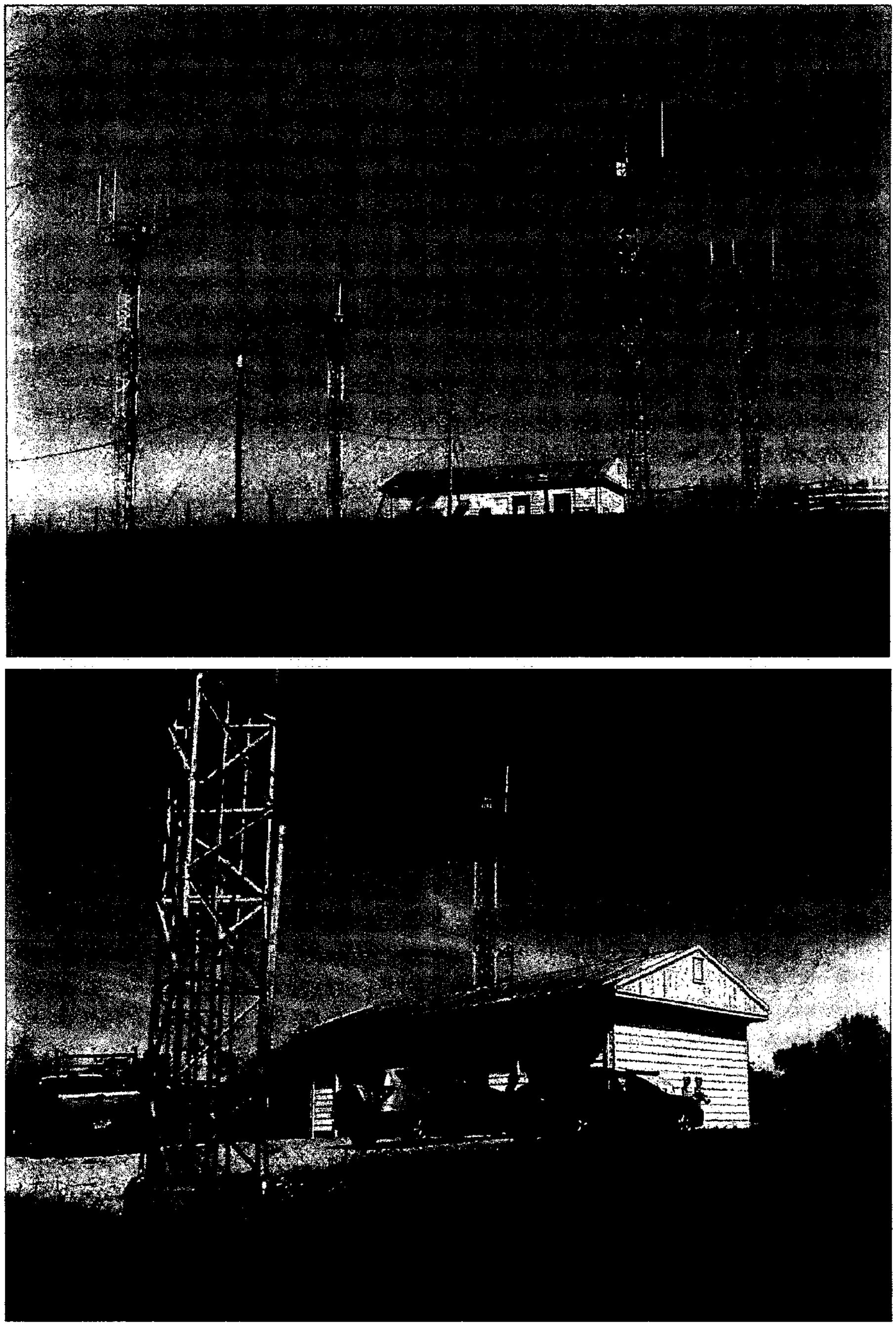


Fig. 4 Surface Structures in the Property

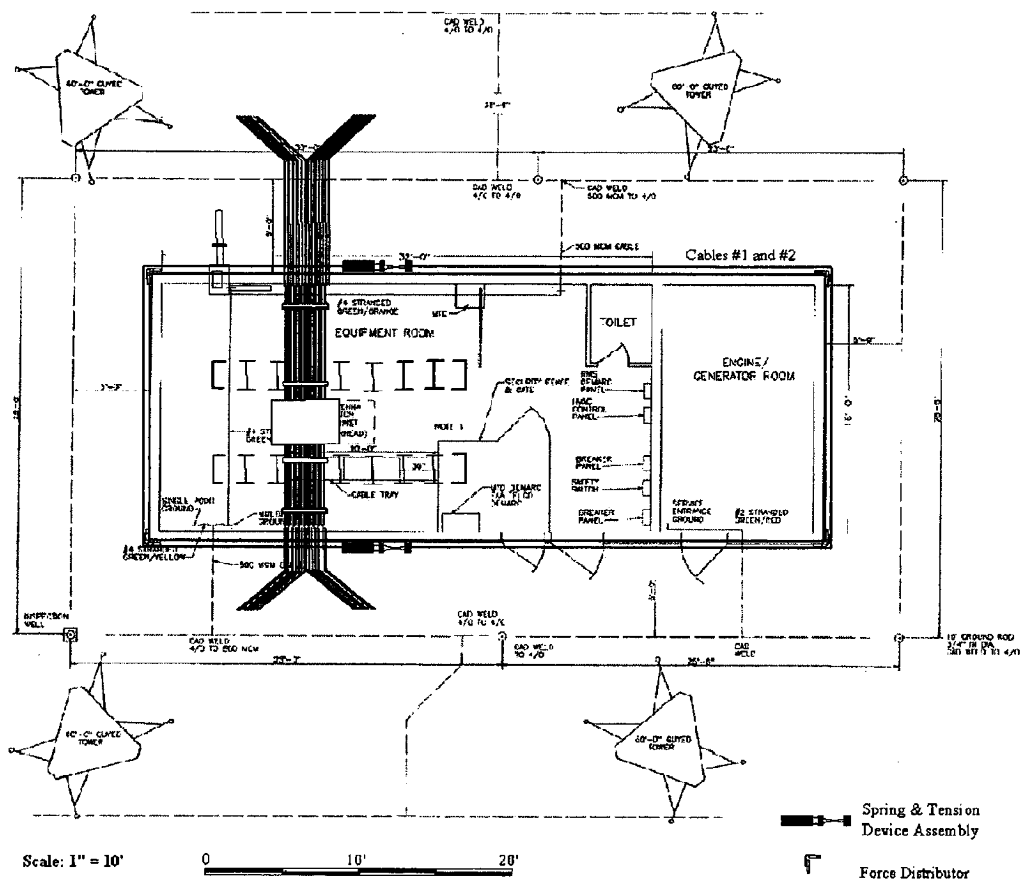


Fig. 5 Layout of the Control Building and Recommended Mitigation Measures

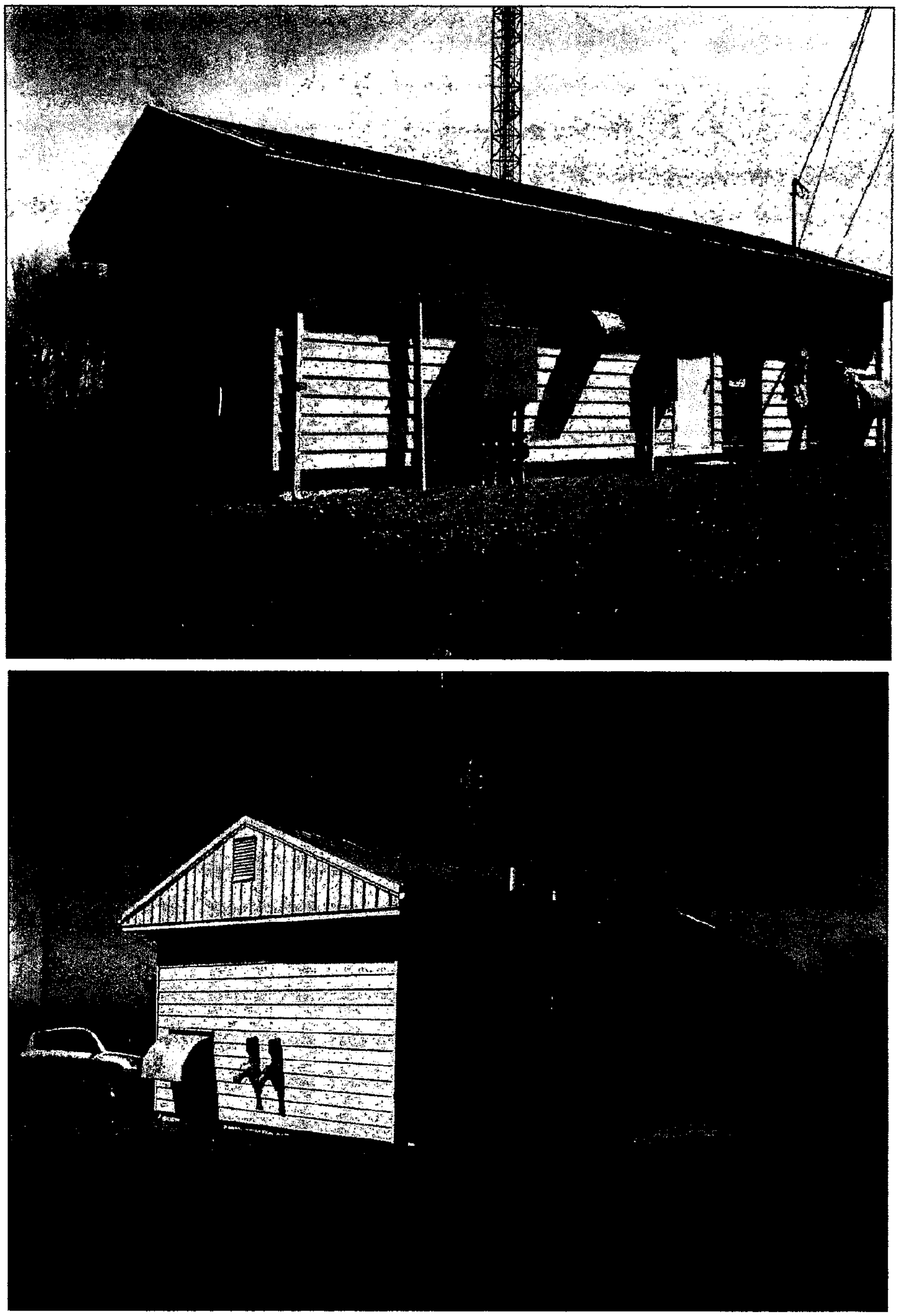


Fig. 6 Front Left (Top) and Rear Right (Bottom) Views of the Control Building

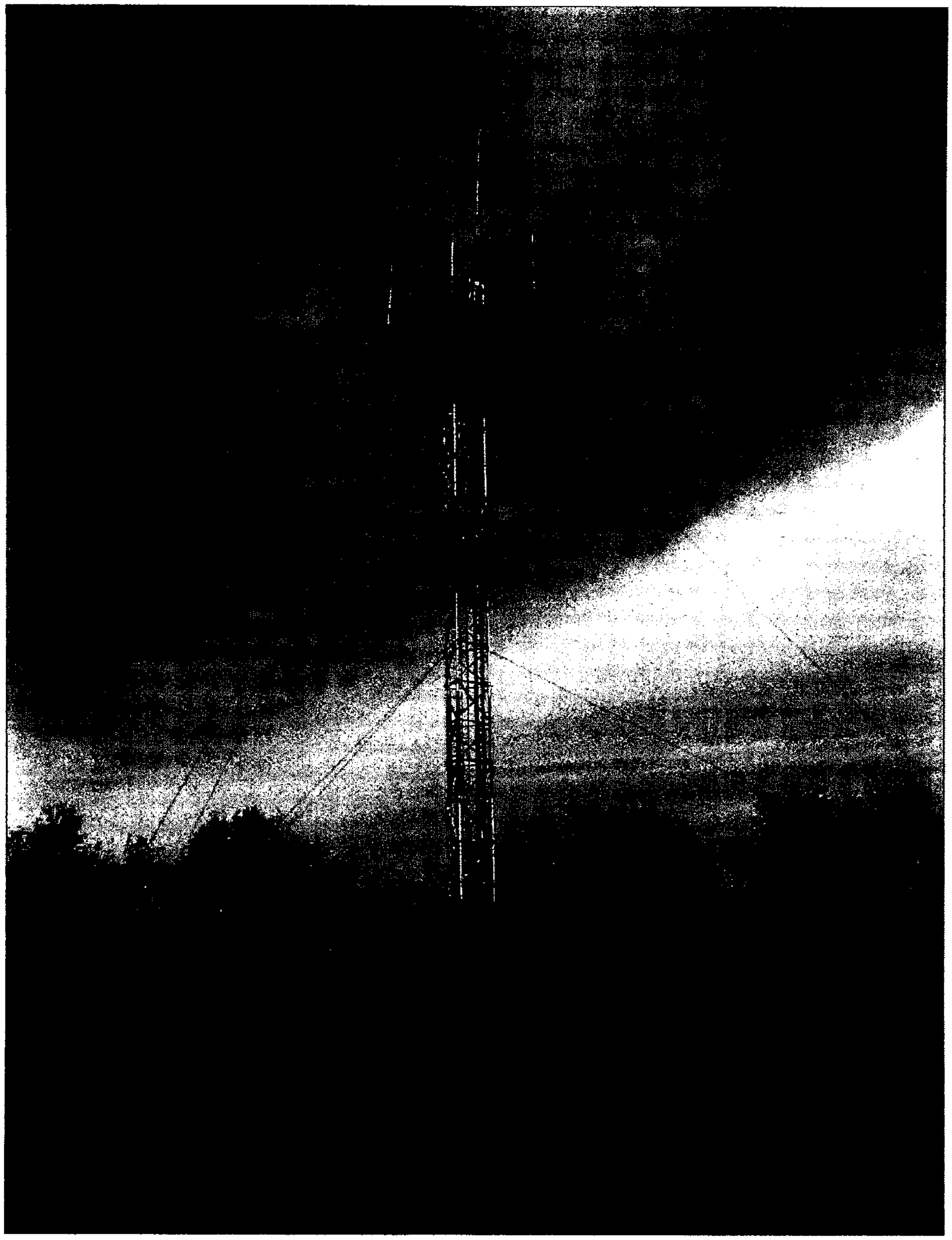
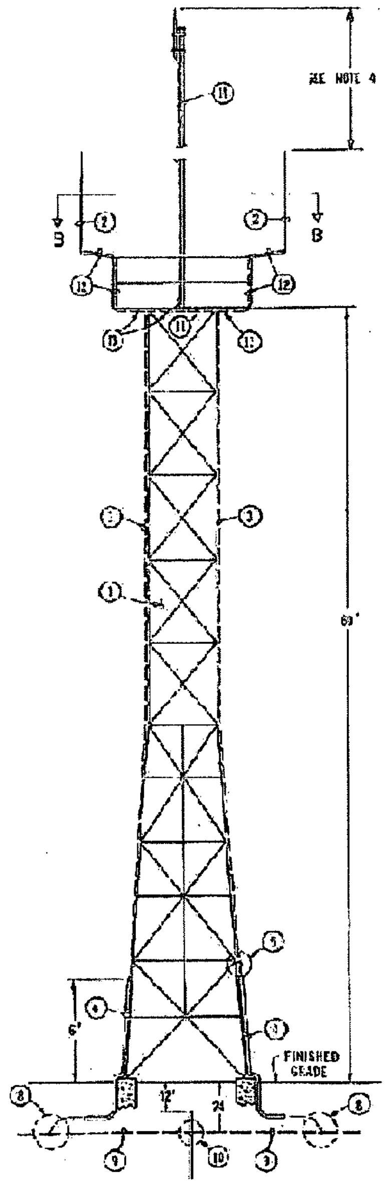
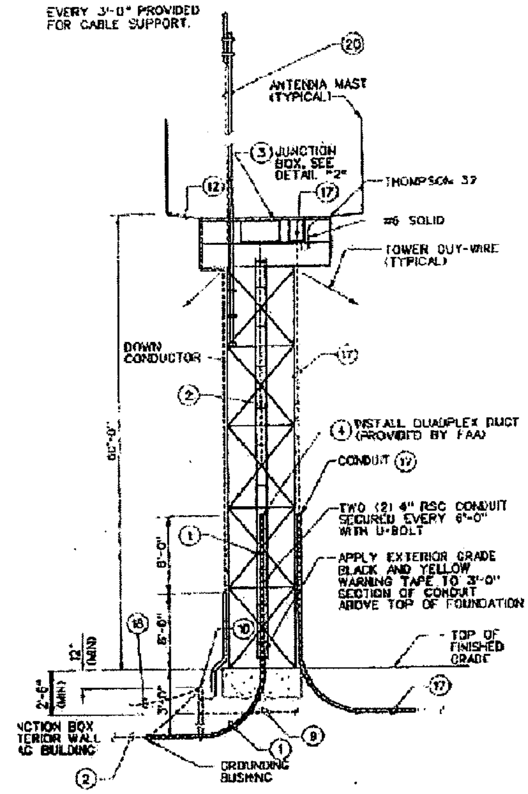


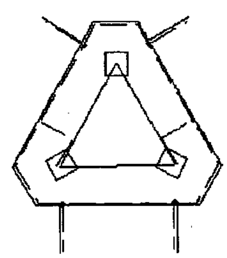
Fig. 7 One of the Four FAA Towers



Tower Structure



Attachments on the Tower



Base

Not in Scale

Fig. 8 Design Details of the Tower Structure and Attachments

A platform is located on the top of the steel lattice tower structure as shown in Fig. 11. Four white pole-antennas are equally spaced along the perimeter of the platform. Unlike the dish type antennas on cellular towers that have been successfully undermined (by American Energy Corporation) which send and receive signals within a narrow angular range, the pole antennas send and receive signals from all directions. The author was told by the FAA representative that the taller green antenna located in the central part of the platform, though still pole type, is somewhat sensitive to direction. Nonetheless, pole antennas, as a class, are much less sensitive to changes in direction than dish antennas. It should be noted that the photos in Figs. 7 and 10 show that some of the FAA antennas were at least a few degrees off from the perfect vertical direction at the time of the pre-mining site visit – an indicator that these pole antennas are not very sensitive to direction. In any event, any concern with tilting can be eliminated if the recommended mitigation measures are implemented.

Fig. 9 Guy Wire Anchor

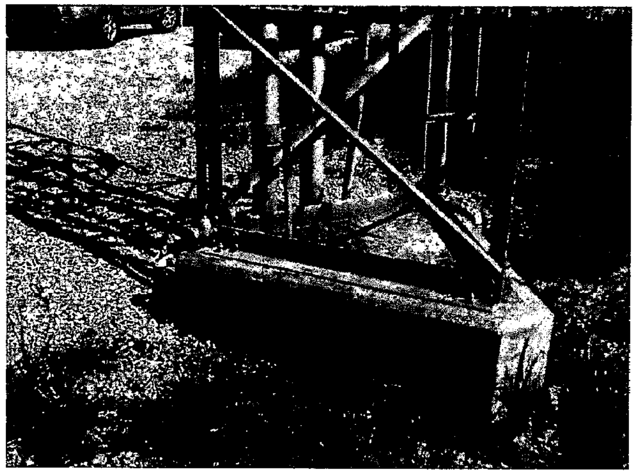


Fig. 10 Connection of the Tower Lattice Structure with its Concrete Base

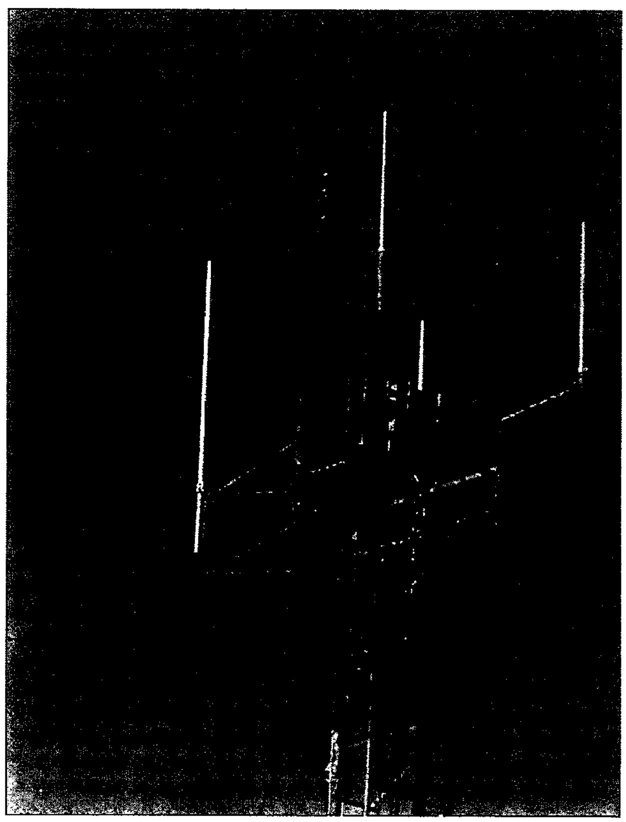


Fig. 11 Antennas Located on Top of Each Tower

- There are eight *buried cable conduits* connected between the equipment building and the four towers. The locations of the cables inside and leaving the control building at its front and rear walls are shown in Fig. 5 while the buried cable conduits are shown in Fig. 3 as the dashed lines. The buried lengths range from 58 to 65 ft. Figure 12 shows that two cable conduits are led to each of the towers. The cable conduits are buried 2.5 ft below the top surface of the concrete tower base or between 2.0 and 2.5 ft below ground surface. The conduits are affixed to the equipment building and the tower with braces and screws as shown in the photos in Fig. 13.

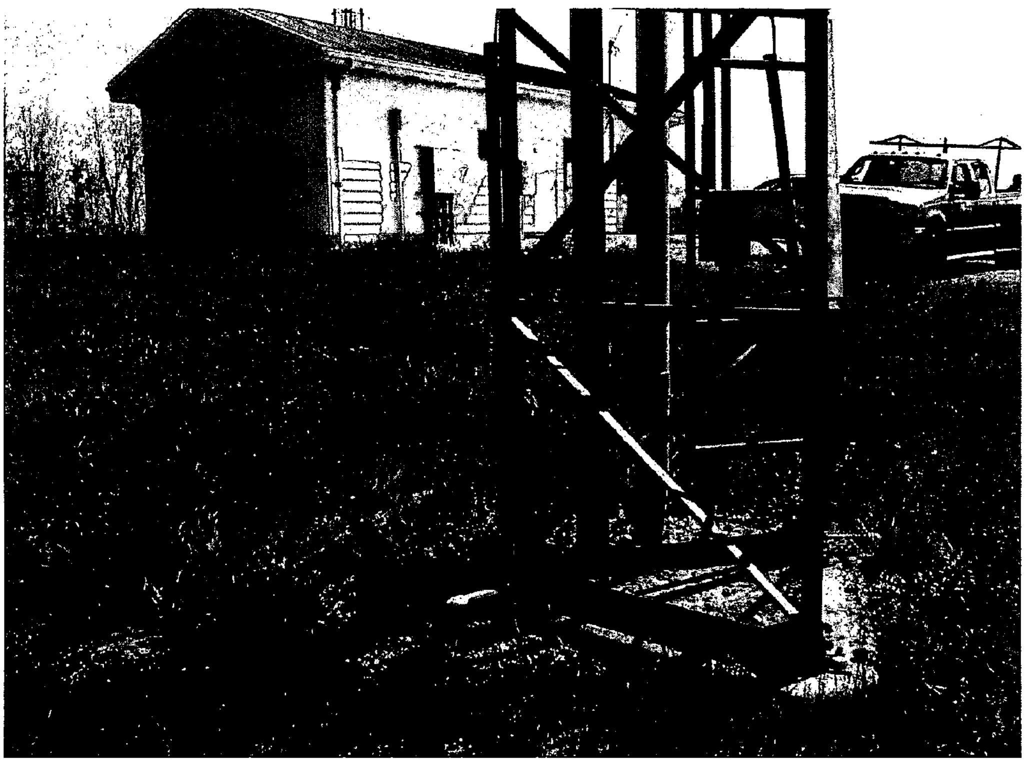


Fig. 12 Above-Ground Portions of the Cable Conduits at the Tower and Control Building

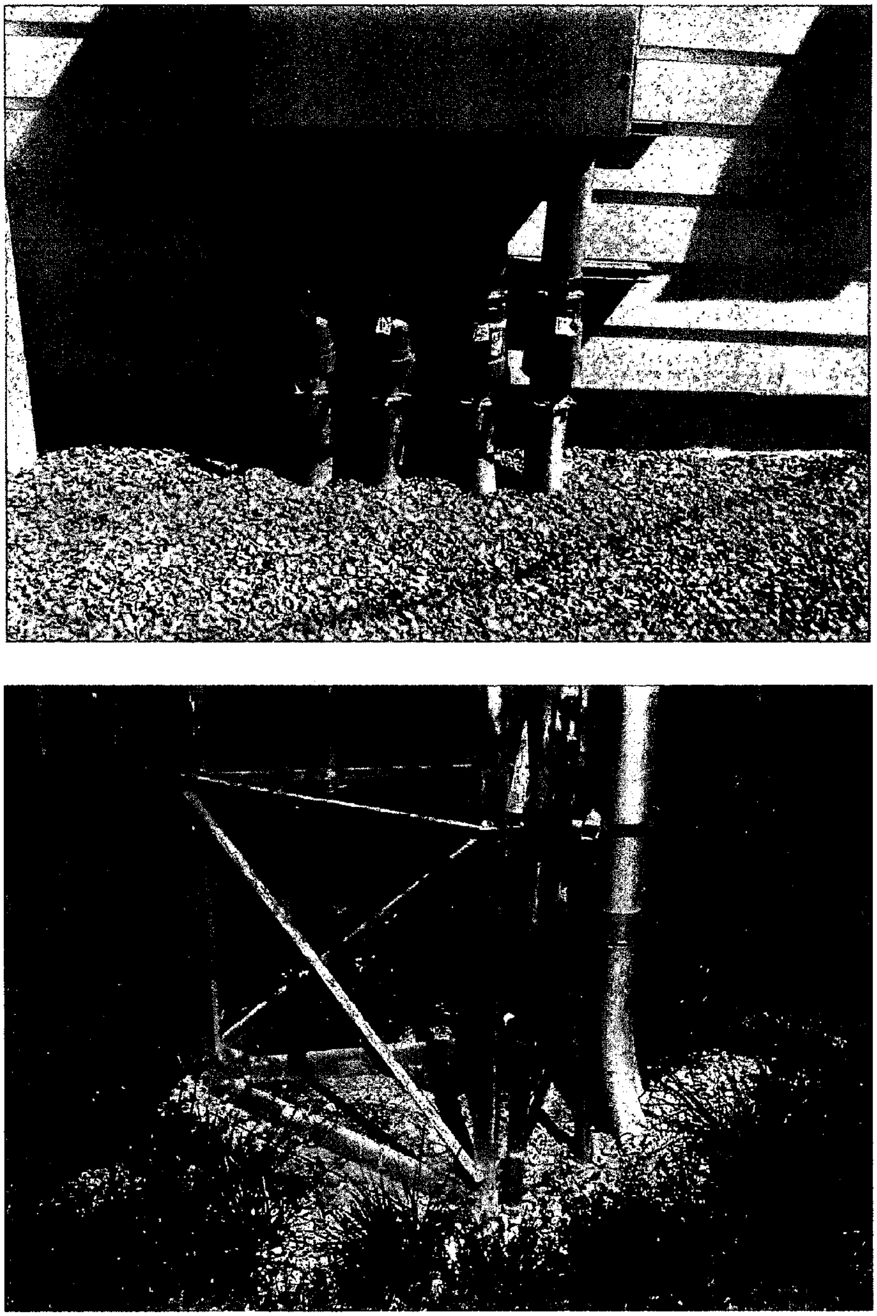


Fig. 13 Affixing the Cable Conduits to the Control Building (Top) and Tower (Bottom)

In addition to the main structures, the other structures within the property include, a water well (depth unknown) located a short distance behind the equipment building, a septic tank, a leaching field, a power terminal pole and a small asphalt paved parking lot as shown in Fig. 3. The power lines attached to the pole (Fig. 14) show sufficient sag for the anticipated subsidence event.

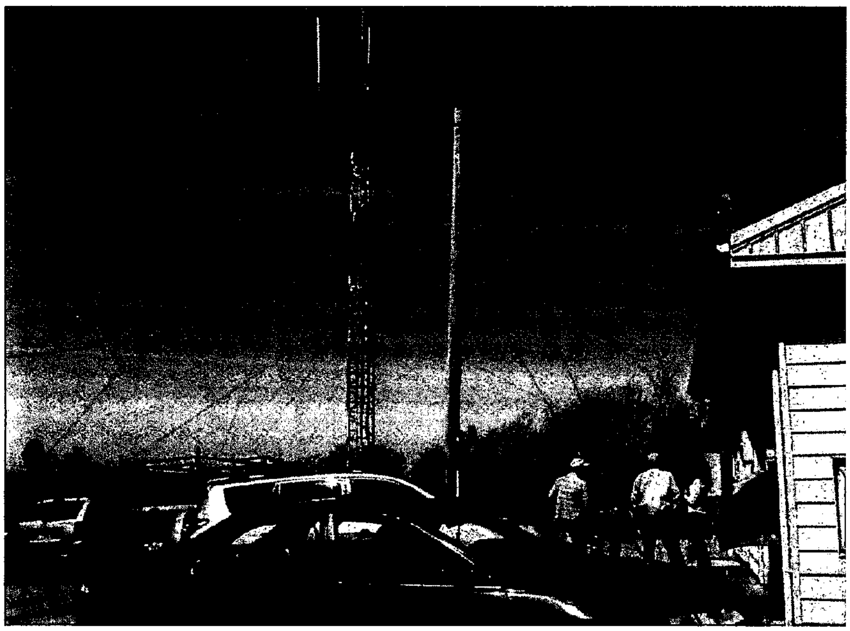


Fig. 14 Power Terminal Pole and the Power Line and Signal Line Attached to the Pole

SUBSIDENCE PREDICTION

In order to assess the potential subsidence influence on the structures within the property, final and dynamic subsidence predictions have been made using the subsidence prediction program CISPM-W developed by the author (Luo et al., 2008). The known mining height of 6.25 ft has been used in the predictions.

The development of the prediction package is based on the influence function method that is widely used in the major mining countries, including the United States. The methodology benefits from a large amount of collected subsidence data, with most being collected over longwall panels mining in the Pittsburgh coal seam, including two sets of data from this particular mine. This subsidence prediction program package has been successfully applied in various subsidence projects over the last two decades and proven accurate.

Final Subsidence Prediction

As mentioned previously, Ohio Valley Coal Company has designed its longwall panels so that the FAA property is located over the central portion of the longwall panel (13 West panel). In order to verify the sufficiency of the mine design and to assess the potential of any permanent influences, final subsidence has been predicted for a rectangular area ABCD around the property. The predicted final surface movements (i.e., subsidence and horizontal displacement) and deformations (i.e., slope, strain and curvature) in the specified area are shown in Figs. 15, 16, 17, 18 and 19, respectively.

Figure 15 shows the predicted final surface subsidence in the specified area. It shows that the entire property is located in the flat bottom portion of the final subsidence basin to be formed over the longwall panel. The final subsidence to be experienced by the entire property is a uniform 4.08 ft.

Figure 16 shows the transverse (along the panel width direction) component of the predicted final horizontal displacement, namely zero. In other words, the site will not have any final horizontal displacement anywhere on the property.

The predicted surface deformations include the following three items: slope (indicating the surface tilting after subsidence), strain (indicating whether the ground surface is stretched or compressed), and curvature (indicating the bending condition of the ground surface). In this section, the component along the panel transverse axis of each type of the predicted final surface deformations is reported since the predicted final surface slope (Fig. 17), strain (Fig. 18), and curvature (Fig. 19) in the specified area are all zero along the longitudinal axis.

Based on the final subsidence prediction, the mine design met its original requirement to place the property in the flat bottom portion of the final subsidence basin to be formed over the longwall panel. The land surface will be approximately four (4) ft lower after subsidence.

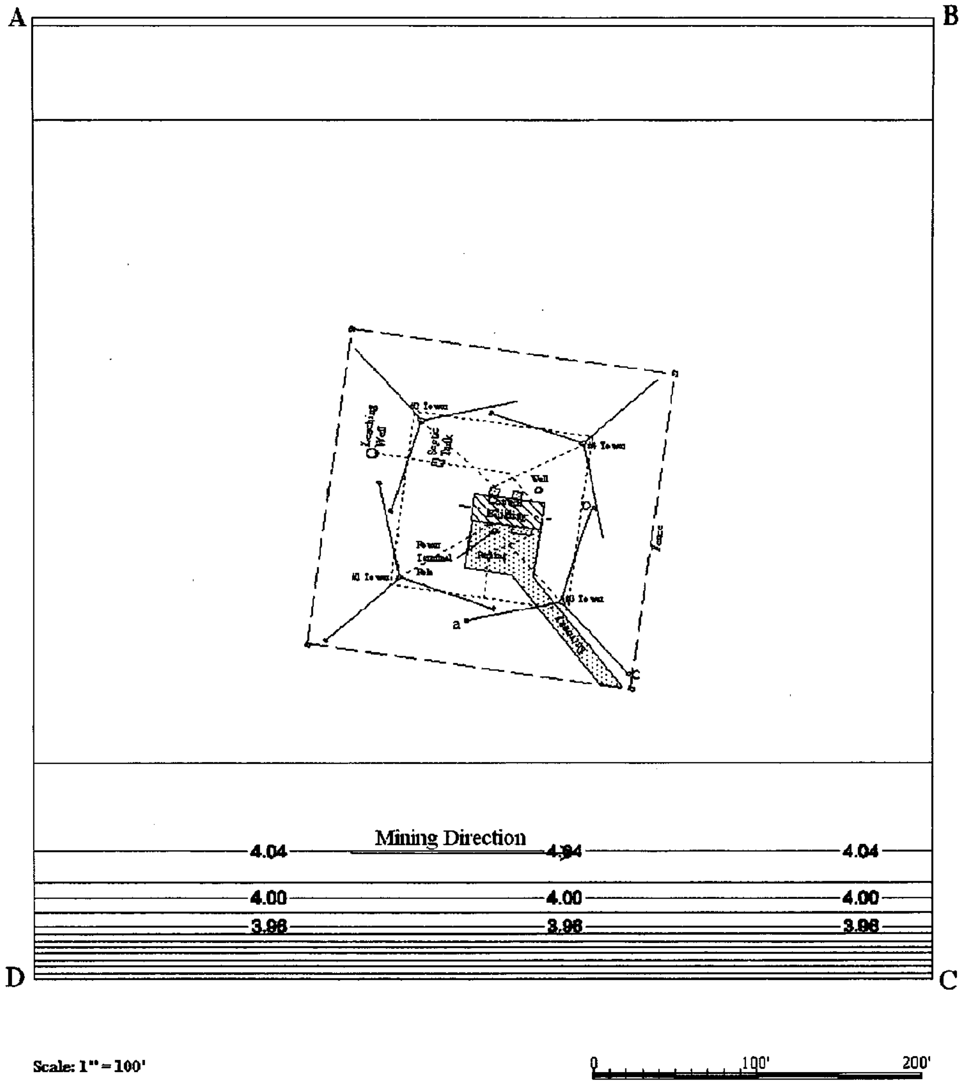


Fig. 15 Predicted Final Surface Subsidence in the Area around the Property

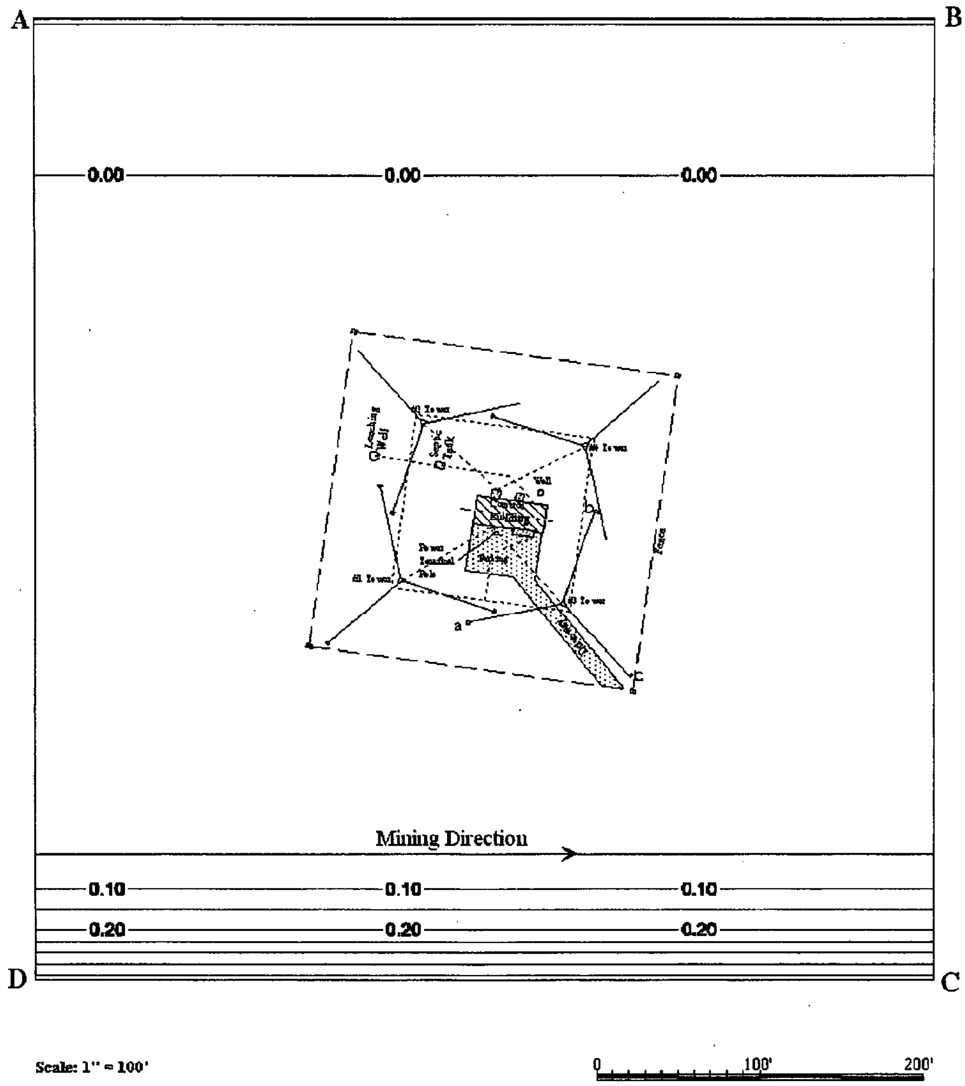


Fig. 16 Predicted Final Surface Horizontal Displacement
(Transverse Component) in the Area around the Property

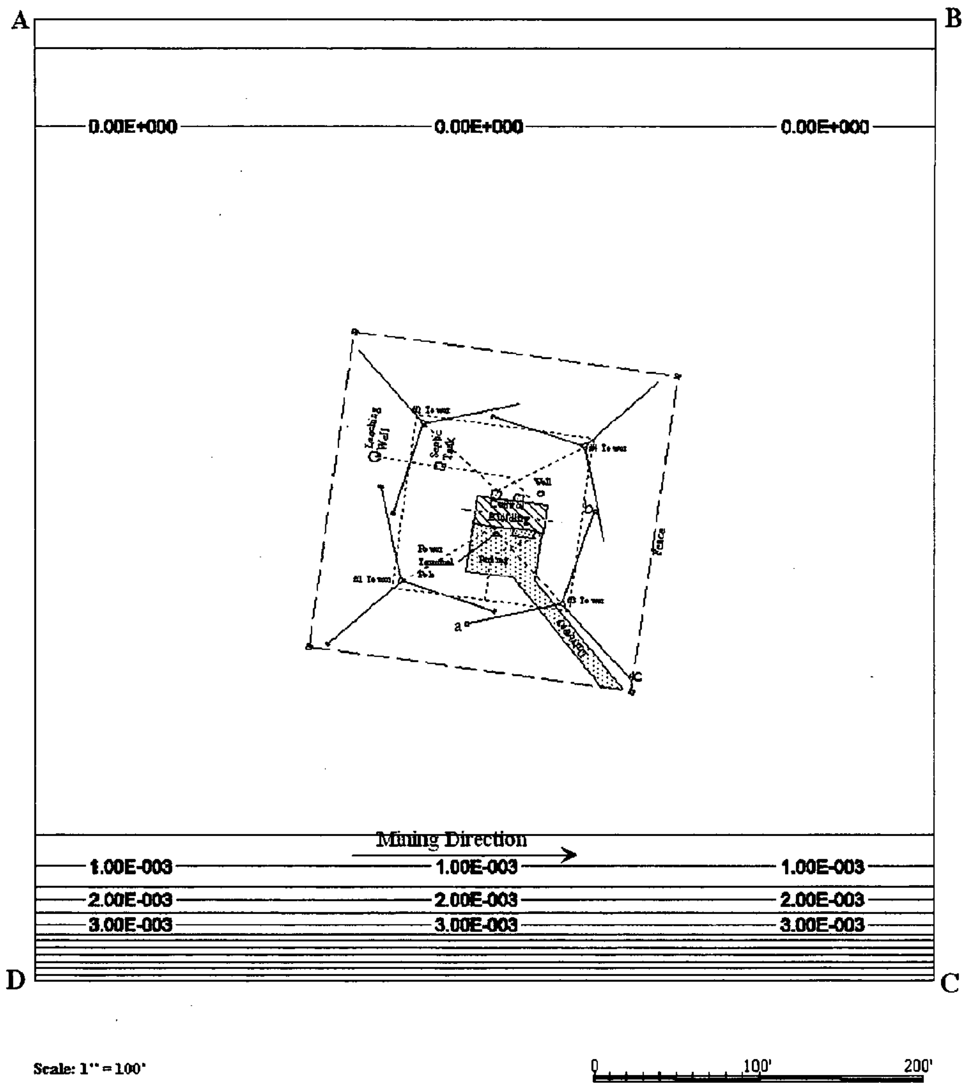


Fig. 17 Predicted Final Surface Slope (Transverse Component)
in the Area around the Property

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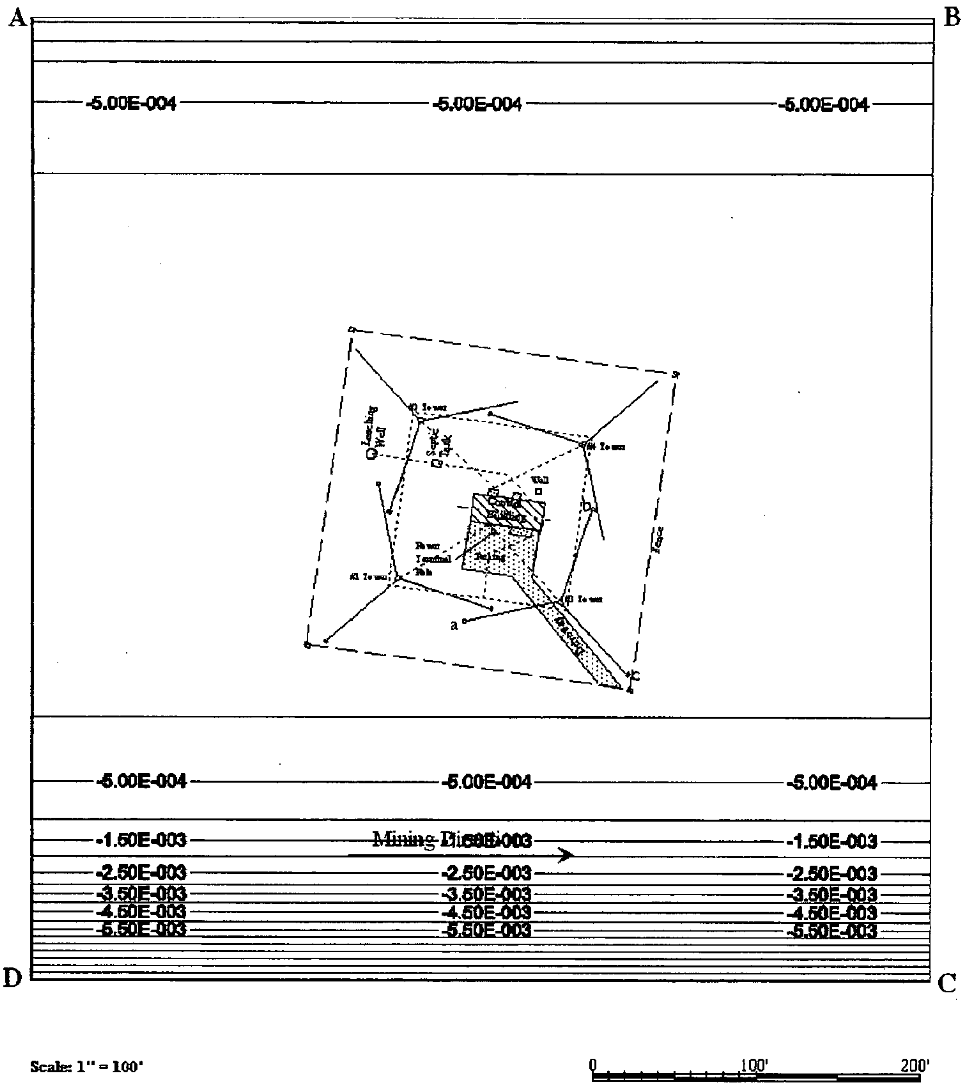

Fig. 18 Predicted Final Surface Strain (Transverse Component)
in the Area around the Property

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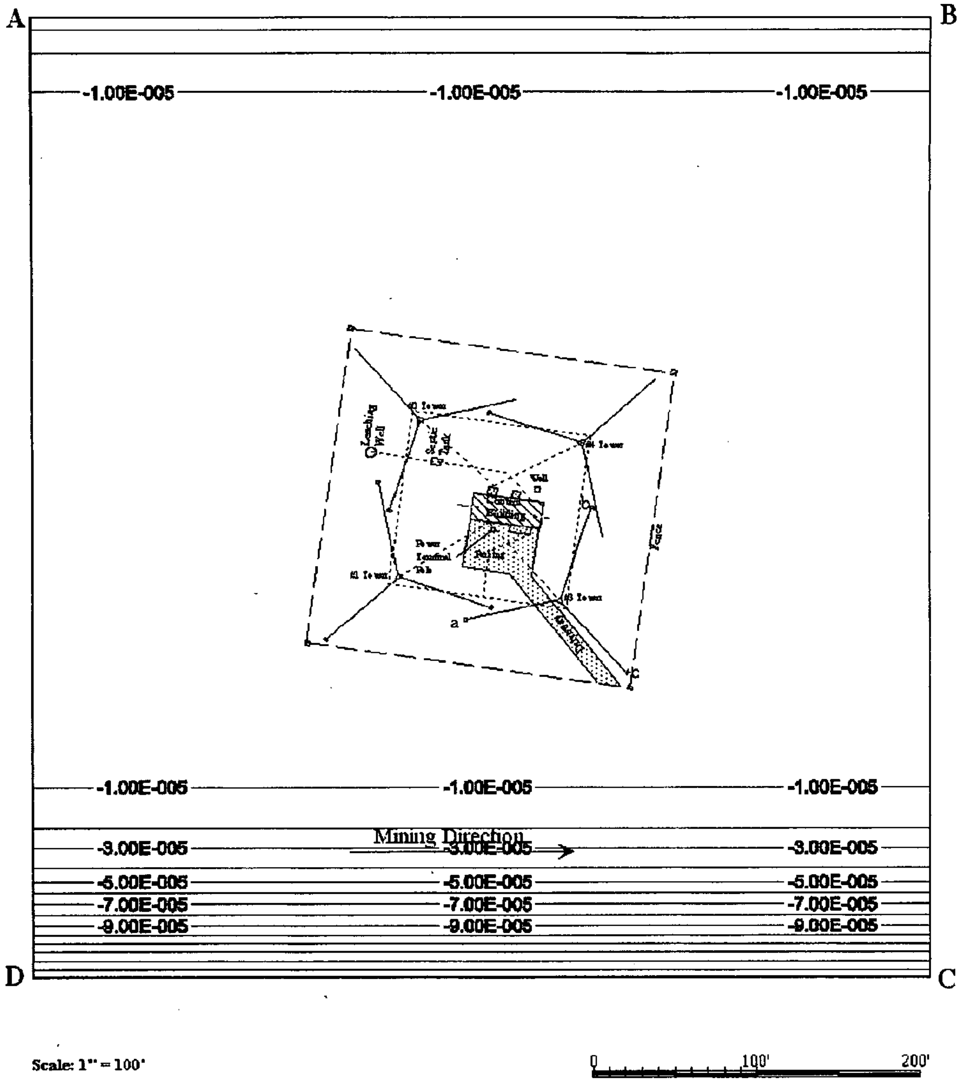

Fig. 19 Predicted Final Surface Curvature (Transverse Component)
in the Area around the Property

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Dynamic Subsidence Prediction

As the mining approaches, proceeds under, and moves beyond the site, a ground point experiences a dynamic (time dependent) subsidence process. This subsidence process is expected to last between ten days and two weeks. Dynamic subsidence predictions have been used to assess the influences of dynamic surface movements and deformations on the structures in order to recommend mitigation. The center of the equipment building (prediction point) is selected for the predictions but every structure within the property will experience the same dynamic subsidence process since they all are within the flat bottom of the subsidence trough. In the dynamic subsidence predictions, longwall face advance rates of 50, 60 and 70 ft/day, commonly achieved at this mine, are used.

Figure 20 shows the development curves of the dynamic subsidence at the prediction point. It shows that a faster face advance rate generates a gentler subsidence development curve. There would be a small subsidence before the longwall face reaches directly under the surface point. The subsidence process accelerates afterwards and reaches about one half of its final subsidence when the longwall face is between 180 and 230 ft past (outby) the surface point. At the same time, the dynamic subsidence process is most active. A decelerating subsidence process follows and the ground surface reaches the predicted final subsidence when the face is about 600 ft outby the surface point of interest.

The predicted development curve for dynamic horizontal displacement (longitudinal component) at the selected point is also plotted in Fig. 21. The negative value in the figure indicates that the movement is against the mining direction. The maximum dynamic horizontal displacement ranges from 0.77 to 0.92 ft when the longwall face is between 180 and 230 ft outby the surface point of interest. Figure 21 also shows that the higher the advance rate, the smaller the maximum dynamic horizontal displacement will be. The ground regains lateral stability when the longwall face has past the surface point of interest a distance of 700 ft.

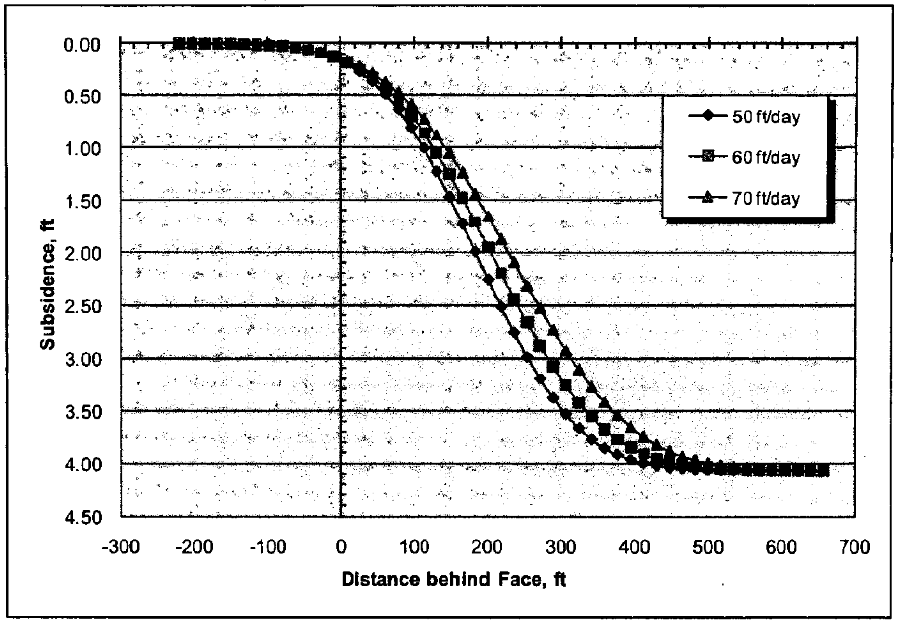

Fig. 20 Development Curves of Predicted Dynamic Subsidence

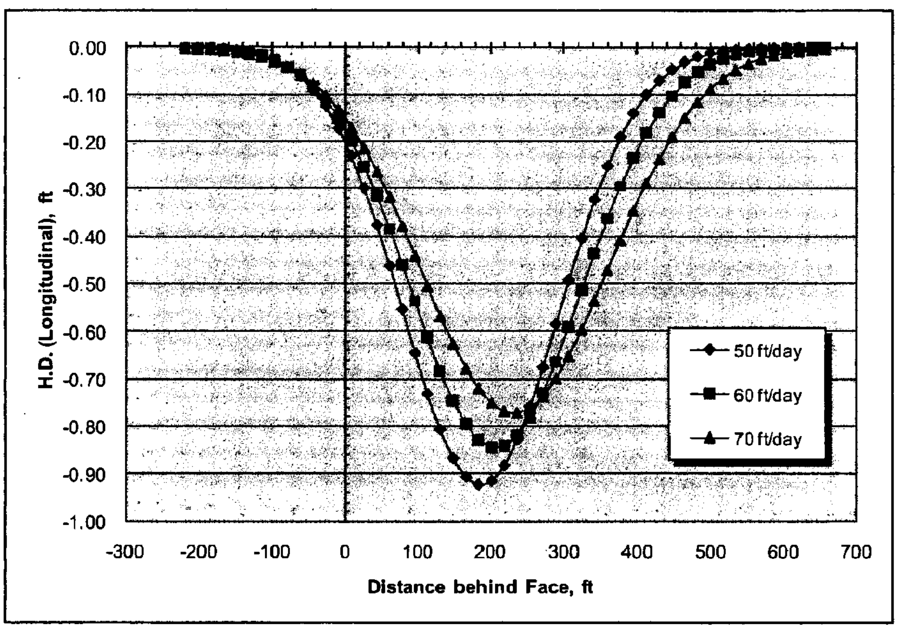

Fig. 21 Development Curves of Predicted Dynamic Horizontal Displacement (Longitudinal Component)

The predicted development curve of dynamic slope (longitudinal component) is plotted in Fig. 22. It has the similar distribution pattern as the dynamic horizontal displacement. The maximum dynamic slope ranging from 1.26% to 1.52% occurs between 180 and 230 ft behind the longwall face. The ground surface at the location of the building regains its "levelness" after the longwall face is 700 ft past the surface point.

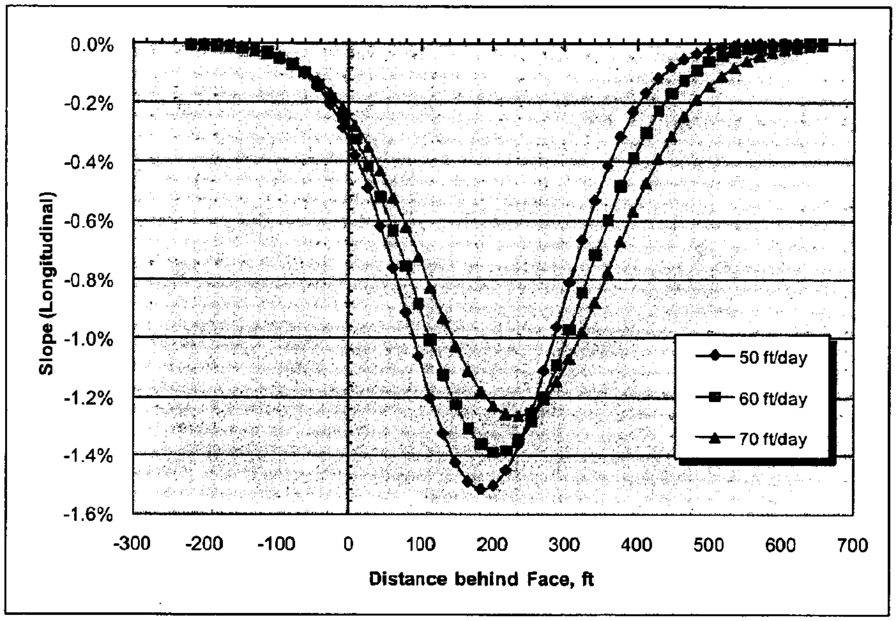

Fig. 22 Development Curves of Predicted Dynamic Slope
(Longitudinal Component)

The predicted development curve of surface dynamic strain (longitudinal component) to be experienced by the equipment building is plotted in Fig. 23. It shows that the ground surface would begin to experience tensile strain when the face is still 150 ft inby the point of interest. The tensile strain would increase as face retreats closer to and passes the point. The maximum dynamic tensile strain, ranging from 3.63×10^{-3} to 5.23×10^{-3} ft/ft, would occur when the longwall face is between 75 and 95 ft ft outby the point of interest. It also shows that the higher the face advance rate, the smaller the maximum tensile strain. Then the tensile strain would reduce and becomes strain free when the face is between 180 and 230 ft past the location. A compressive strain condition would follow and the maximum compressive strain of -3.63×10^{-3} to -5.22×10^{-3} ft/ft would occur when the face is between 290 and 350 ft outby the point of interest. The ground becomes strain free after the face has past the point of interest a distance of about 700 ft.

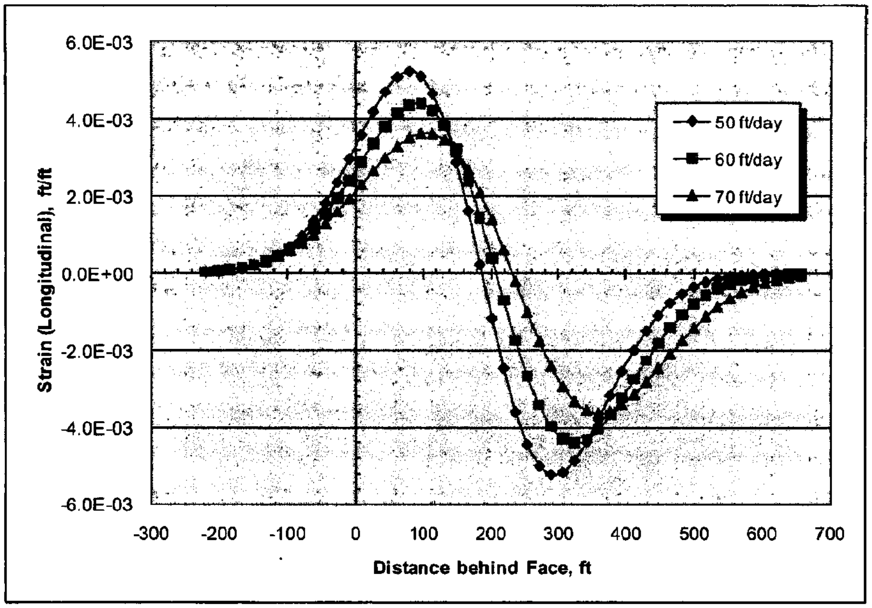

Fig. 23 Development Curves of Predicted Dynamic Strain
(Longitudinal Component)

The development curve of surface dynamic curvature (longitudinal component) at the equipment building is shown in Fig. 24. The distribution of the dynamic curvature is similar to that of dynamic strain. The maximum dynamic convex curvature ranges from 6.0×10^{-5} 1/ft to 8.6×10^{-5} 1/ft while the maximum dynamic concave curvature is between - 5.8×10^{-5} to - 8.6×10^{-5} 1/ft.

SUBSIDENCE INFLUENCES ON CONTROL BUILDING

As mentioned previously, the final surface movements and deformations would not affect the integrity, stability and functionality of the structures in the FAA Belmont

Communication Station. However, the dynamic subsidence process for the area to experience before the final state is reached could affect the structures to various degrees. In this section, the potential effects of dynamic subsidence process to the main structures are assessed based on the results of the subsidence predictions. It should be mentioned that all the assessed influences are those without proper mitigations being implemented. The mitigation measures to prevent such influences are covered in a later section.

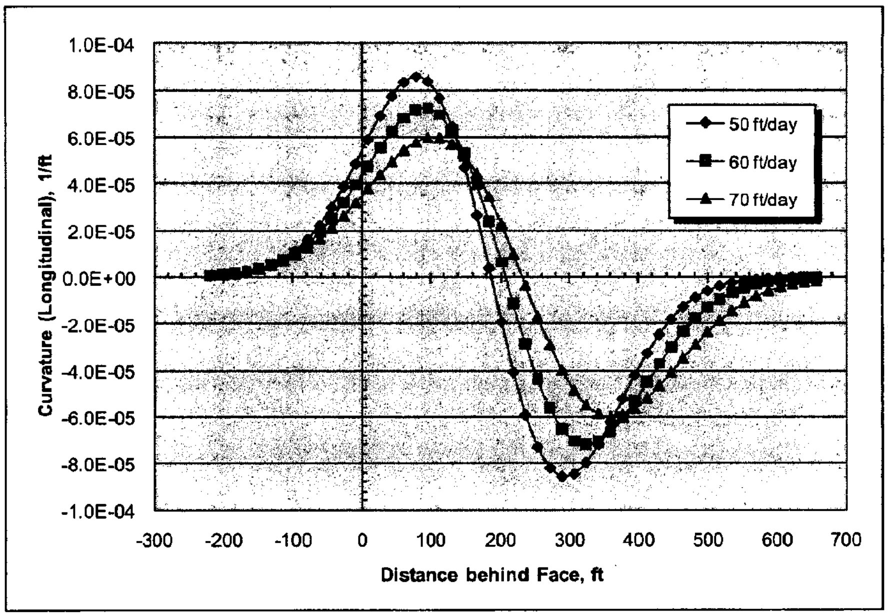

Fig. 24 Development Curves of Predicted Dynamic Curvature
(Longitudinal Component)

Based on the predicted dynamic surface movements and deformations, the possible subsidence influences on the structures have been assessed. In the assessment, the critical deformation values deduced from extensive subsidence monitoring programs performed by the authors on various residential structures affected by longwall subsidence are used. To assess the subsidence influences on structures, the size, shape, complexity, materials, construction method and existing condition of the structures are also considered in the assessment. The critical deformation values applicable to structures in this property are as follows.

Critical slope for comfortable living:	1.00%
Critical tensile strain for brick and block foundation walls:	$2.0\text{x}10^{-3}$ ft/ft
Critical curvature for house super-structure:	$6.0\text{x}10^{-5}$ 1/ft

Among the predicted dynamic deformations, the maximum dynamic slope ranging from 1.26% to 1.52% would be over the critical slope for comfortable human living. The time period that this critical slope is exceeded will be when the longwall face has past a surface point between 80 and 320 ft (4 to 5 days for the face advance rates). A slope larger than 1% for a residential structure is something a sensitive person can visually detect. Since the building is not a residential structure, its critical slope might be different from the listed one. Based on the previous experiences working with control buildings for cellular phone transmission towers and power substations, the slopes at such magnitude have never caused any problems to the equipment hosted inside.

The predicted maximum dynamic tensile strain in the range of 3.63×10^{-3} to 5.23×10^{-3} ft/ft is capable of causing cracks to the concrete foundation and slab floor pavement. The most possible locations for the cracks could be the existing joint lines along the width direction of the building. The total width of the cracks could be up to 2.5 inches if the building is not properly protected.

The maximum convex curvature to be experienced is in the range from 6.0×10^{-5} to 8.6×10^{-5} 1/ft. Curvature at such magnitude may be able to create some minor problems to the wood frame structure, including sticky door and windows as well as hairline cracks at the upper corners of the doors and windows.

It should be noted that these anticipated dynamic subsidence influences would last a short time period (a few days for the face advance rates used). They can be mitigated with tension cable methods to be mentioned later.

SUBSIDENCE INFLUENCES ON GUYED TOWERS

Determination of Movement of the Ties

During the dynamic subsidence process, the four ground-contacting points of a guyed tower (i.e., the three anchors and the base) would move differently. The differential ground movements, being transformed through the guy wires and the tower lattice structure, would induce additional stresses on the wires and tower structure and cause tilting and rotations to the tower structure. In this section, such potential influences are assessed.

By examining the four towers, No. 3 tower (blue highlighted in Fig. 3) would be affected most by the dynamic subsidence process because of its orientations of the guy wires with respect to the mining direction in the panel. Therefore, No. 3 tower has be selected for the studying the subsidence influences. The three anchors of this tower is named as *a*, *b* and *c*.

The first step for the analysis is to predict the dynamic movements of the four ground-contacting points. To simplify the analysis, a local coordinate system is used as shown in Fig. 3 using the base of No. 3 tower as the reference line for x-axis. The y-axis is the tailentry of the panel. The pre-mining coordinates of the points are shown in Table 1. The plan view of the ground-contacting points is shown in Fig. 25. It shows that the guy wires connecting to anchor *a* forms an angle of 11.5° with the mining direction.

Table 1 Coordinates of the Ground-Contacting Points and Ties of No. 3 Tower

Point	x	y	z*	Between Points	Horiz. Distance	Angle to Mining Direction		Tie Elevations in Relation to Base		Original Guy Wire Length, *ft*		Original Tensions in Guy Wires *lbs*	
Base (0)	0	487	0		*ft*	*Rad.*	*Deg.*	Tie 1	Tie 2	Tie 1	Tie 2	Tie 1	Tie 2
Anchor a	-59	475	0	0-a	60.21	0.20	11.50	30	60	67.27	85.00	200	200
Anchor b	19	544	0	0-b	60.08	1.25	71.57	30	60	67.16	84.91	200	200
Anchor c	40	442	-1	0-c	60.21	-0.84	-48.37	30	60	67.72	85.71	200	200

* Elevations are expressed in relation to the tower base

A plane formed with the guy wires from one anchor and the tower structure is shown in Fig. 26. Since the anchor may be a few ft (the maximum is 2 to 3 ft) below or above the base of the tower, the inclination angles of the guy wires may be slightly different from one plane to another.

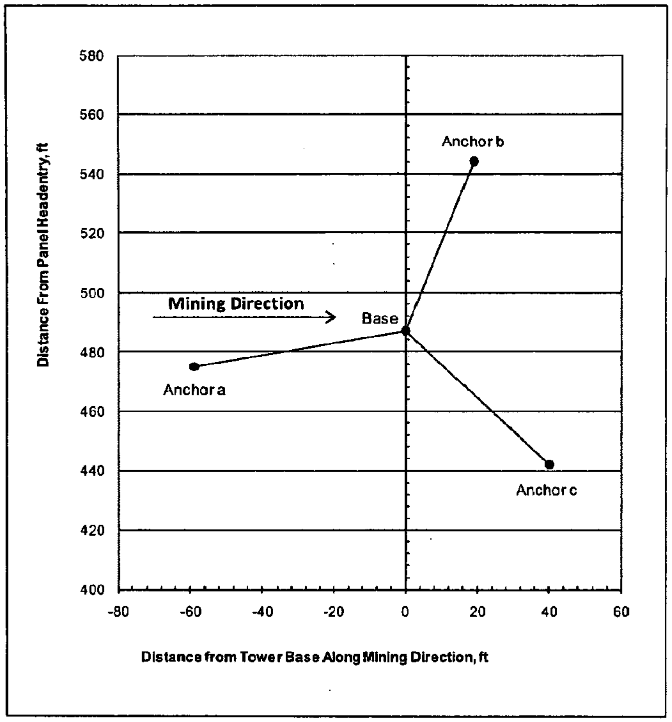

Fig. 25 Layout of the Ground-Contacting Points of No. 3 Tower

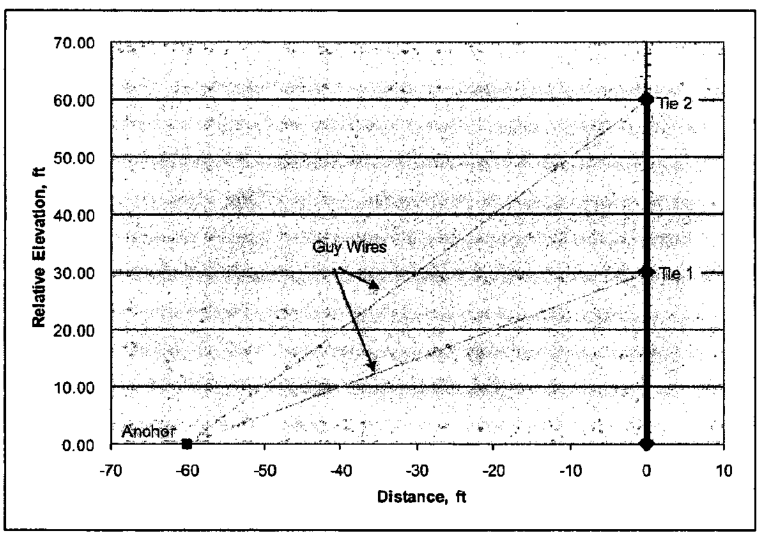

Fig. 26 A Guy Wire Plane

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Dynamic surface movements (i.e., the subsidence, and the longitudinal, x, and transverse, y, components of horizontal displacement) have been predicted for 14 selected time stages ranging from when the longwall face is 200 ft inby to 800 ft outby the tower base as shown in Table 2. These time stages are chosen to cover the active dynamic subsidence process and smaller steps are used when the tower experiences the most subsidence influences. A slow face advance rate of 50 ft/day is used in the prediction for a more conservative study. The predicted surface subsidence (*S*) and the two components of horizontal displacement (U_x and U_y along the x and y directions, respectively) at these specified time stages are listed in Table 2. Since these towers are located in the central portion of the longwall panel, the transverse component of the dynamic horizontal displacements is always zero.

Table 2 Predicted Dynamic Surface Movements at the Ground-Contacting Points

Surface Point	Move	Predicted Dynamic Movements at Following Face Locations*, *ft*													
		-200	-100	0	100	150	200	250	300	350	400	500	600	700	800
Base (0)	S	0.000	0.000	0.006	0.266	0.835	1.731	2.644	3.321	3.727	3.940	4.065	4.077	4.077	4.077
	U_x	0.000	0.000	-0.013	-0.305	-0.620	-0.805	-0.720	-0.519	-0.304	-0.148	-0.018	-0.001	0.000	0.000
	U_y	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Anchor a	S	0.000	0.001	0.069	0.961	1.886	2.772	3.401	3.774	3.959	4.040	4.075	4.077	4.077	4.077
	U_x	0.000	-0.002	-0.110	-0.671	-0.800	-0.699	-0.479	-0.277	-0.128	-0.049	-0.004	0.000	0.000	0.000
	U_y	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Anchor b	S	0.000	0.000	0.002	0.152	0.571	1.368	2.317	3.098	3.600	3.878	4.056	4.076	4.077	4.077
	U_x	0.000	0.000	-0.006	-0.202	-0.501	-0.769	-0.773	-0.604	-0.380	-0.200	-0.029	-0.002	0.000	0.000
	U_y	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Anchor c	S	0.000	0.000	0.001	0.075	0.348	0.995	1.924	2.803	3.421	3.784	4.041	4.075	4.077	4.077
	U_x	0.000	0.000	-0.002	-0.116	-0.364	-0.682	-0.800	-0.691	-0.470	-0.270	-0.047	-0.003	0.000	0.000
	U_y	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

* in terms of distance past the base of the tower

Figure 27 shows the predicted subsidence development curves at the four points of interest. Insignificant amount of subsidence will be experienced by the tower structures when the longwall face is directly under the tower base. The subsidence process will be very active when the face is between 100 and 300 ft past the tower base. The ground begin to regain stability after the face has past the tower base a distance of 600 ft. The figure also shows that the largest differential subsidence occurs between anchor point *a* and other points. However, when the final subsidence is reached, all points will reach its maximum amount of 4.08 ft.

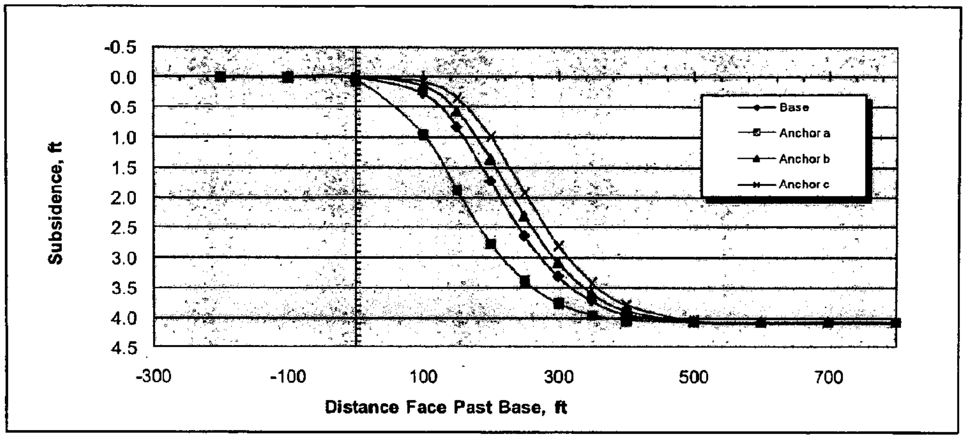


Fig. 27 Predicted Dynamic Subsidence

The predicted development curves of horizontal displacements along the mining direction are plotted in Fig. 28. The negative values shown in the figure indicate that the movements are against the mining direction.

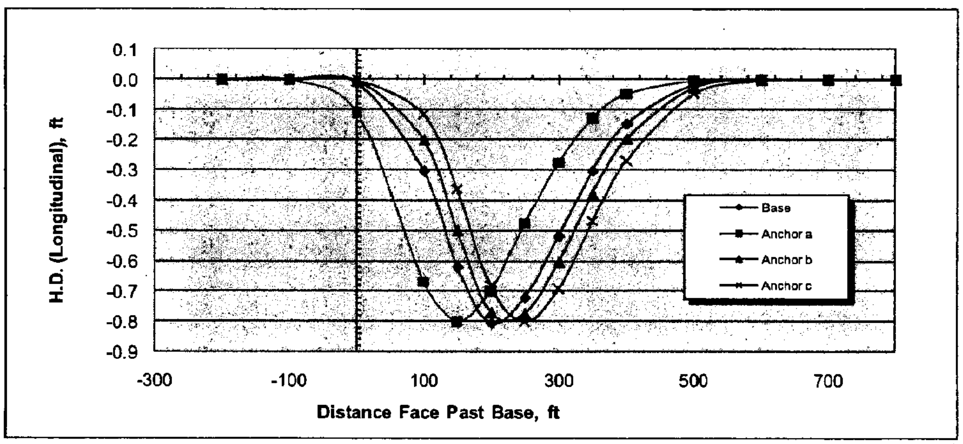


Fig. 28 Predicted Dynamic Horizontal Displacement
Along Mining Direction

These predicted surface movements will be used in the subsequent section to analyze the subsidence influences to the structural stability, integrity and functionality of the tower.

Assessment of Structural Integrity

As the ground subsides, the relative spatial locations of the tower base and the anchors (the ground-contacting points of the guyed tower structure) will change. Such changes in elevations and coordinates of these ground-contacting points could induce additional tensions in the guy wires and additional loads in the tower structure (Luo et al, 2003).

In the determination process, the predicted dynamic surface movements at the tower base and the anchors at a given time stage are imposed on their respective original coordinates and elevations. The new coordinates and elevations of the tower base and the anchors at various time stages are listed in Table 3. The most important task is to determine the coordinates of the ties on the tower when a new equilibrium is developed in the tower structure at a given time. Since the guy wires tied to each of the two ties (1 and 2 in Fig. 26) on the tower are of the same size, the following conditions should be satisfied when a new equilibrium at each tie position is reached.

$$\begin{cases} \sum_{i=1}^{3} \varepsilon_i \cos\beta_i \cos\alpha_i = 0 \\ \sum_{i=1}^{3} \varepsilon_i \sin\beta_i \cos\alpha_i = 0 \end{cases} \tag{1}$$

In Equation 1, ε_i is the additional strain developed in the guy wire connected between anchor *i* (i.e., *a*, *b* and *c*) and the tie of interest (i.e., 1 or 2). The horizontal angle between this guy wire and the mining direction is β_i while the slope angle is expressed as α_i. The additional strain in this guy wire is determined as:

$$\varepsilon_i = \frac{\sqrt{(x_i - x_o)^2 + (y_i - y_o)^2 + (z_i - z_o)^2} - L_o}{L_o} \tag{2}$$

In equation 2, x_i, y_i, and z_i are the coordinates and elevation of ground anchor *i* at a given time stage shown in Table 3. The coordinates and elevation at a given tie on the tower are x_o, y_o, and z_o. The original length of the guy wire is L_o listed in Table 1. In setting up equations 1 and 2, the following two reasonable assumptions are made:

- The vertical deformation of the tower structure is insignificant. Therefore, the new elevation at a tie position z_o is equal to the elevation of the subsiding tower base plus the original height of this tie as listed in Table 3.

- The ability for the tower structure itself at the tie levels to resist lateral displacement is insignificant.

By solving the two simultaneous nonlinear equations (Eq. 1), the coordinates, x_o and y_o, of each of the two ties can be determined at a given time stage when the new equilibrium of the tower structures is reached. A special program has been developed for solving the simultaneous nonlinear equations involved in this task. Using the program repeatedly, the coordinates for the two ties are determined and listed in Table 3. The horizontal displacements (x-component, y-component and principal, Δx, Δy and ΔU) of these three ties relative to the tower base are determined and the results are also listed in Table 3. The development curves of the horizontal displacements of ties 1 and 2 are shown in Figs. 29 and 30, respectively. A positive horizontal displacement along the panel transverse direction indicates movement toward the headentry of the panel.

Additional Tensions in Guy Wires

Using these determined coordinates of the ties and the anchors, the additional strains in the guy wires on the tower are determined and shown in Table 4. In converting the additional strain (Eq. 2) to the additional tension, the stiffness of the steel guy wire rope (S) is determined based on the average value of 6-strand steel wire ropes as:

$$S = 10 \times 10^{6} A \qquad \text{lbs} \tag{3}$$

In Eq. 3, A is the cross-sectional area of the wire rope. The stiffness values used in the conversion are shown in Table 4. The determined tensions in the guy wires induced by the ground subsidence process associated with the longwall operation are also shown in Table 4 and Fig. 31. A positive value indicates that an additional tension has been induced in the guy wire by the subsidence process. A negative value shows that the existing tension in the guy wire observed before mining will be reduced as shown in Table 1. A negative force is only meaningful when its magnitude is smaller than the premining tension.

Table 3 Predicted Coordinates of the Ground-Contacting Points and the Ties on the Tower

Point	Coord	Coordinates at Various Points of the Guyed Tower Structure 3*, ft													
		-200	-100	0	100	150	200	250	300	350	400	500	600	700	800
Base (0)	x	0.000	0.000	-0.013	-0.305	-0.620	-0.805	-0.720	-0.519	-0.304	-0.148	-0.018	-0.001	0.000	0.000
	y	487.000	487.000	487.000	487.000	487.000	487.000	487.000	487.000	487.000	487.000	487.000	487.000	487.000	487.000
	z	0.000	0.000	-0.006	-0.266	-0.835	-1.731	-2.644	-3.321	-3.727	-3.940	-4.065	-4.077	-4.077	-4.077
Anchor a	x	-59.000	-59.002	-59.110	-59.671	-59.800	-59.699	-59.479	-59.277	-59.128	-59.049	-59.004	-59.000	-59.000	-59.000
	y	475.000	475.000	475.000	475.000	475.000	475.000	475.000	475.000	475.000	475.000	475.000	475.000	475.000	475.000
	z	0.000	-0.001	-0.069	-0.961	-1.886	-2.772	-3.401	-3.774	-3.959	-4.040	-4.075	-4.077	-4.077	-4.077
Anchor b	x	19.000	19.000	18.994	18.798	18.499	18.231	18.227	18.396	18.620	18.800	18.971	18.998	19.000	19.000
	y	544.000	544.000	544.000	544.000	544.000	544.000	544.000	544.000	544.000	544.000	544.000	544.000	544.000	544.000
	z	0.000	0.000	-0.002	-0.152	-0.571	-1.368	-2.317	-3.098	-3.600	-3.878	-4.056	-4.076	-4.077	-4.077
Anchor c	x	40.000	40.000	39.998	39.884	39.636	39.318	39.200	39.309	39.530	39.730	39.953	39.997	40.000	40.000
	y	442.000	442.000	442.000	442.000	442.000	442.000	442.000	442.000	442.000	442.000	442.000	442.000	442.000	442.000
	z	-1.000	-1.000	-1.001	-1.075	-1.348	-1.995	-2.924	-3.803	-4.421	-4.784	-5.041	-5.075	-5.077	-5.077
Tie 1	x	0.000	-0.001	-0.094	-0.760	-1.136	-1.247	-1.039	-0.709	-0.403	-0.198	-0.028	-0.001	0.000	0.000
	y	487.000	486.999	486.981	486.878	486.886	486.982	487.075	487.101	487.084	487.056	487.012	487.001	487.000	487.000
	z	30.000	30.000	29.994	29.734	29.165	28.269	27.356	26.679	26.273	26.060	25.935	25.923	25.923	25.923
Tie 2	x	0.000	-0.002	-0.116	-1.039	-1.612	-1.786	-1.479	-0.995	-0.559	-0.271	-0.037	-0.002	0.000	0.000
	y	487.000	486.999	486.977	486.844	486.854	486.980	487.099	487.129	487.104	487.068	487.014	487.001	487.000	487.000
	z	60.000	60.000	59.994	59.734	59.165	58.269	57.356	56.679	56.273	56.060	55.935	55.923	55.923	55.923

* in terms of distance past the base of the tower

Point	Displace	Displacements at the Ties of Guyed Tower Structure with Respect to Its Base, ft													
		-200	-100	0	100	150	200	250	300	350	400	500	600	700	800
Tie 1	Δx	0.0000	-0.0015	-0.0806	-0.4551	-0.5162	-0.4416	-0.3188	-0.1901	-0.0993	-0.0502	-0.0099	-0.0005	0.0000	0.0000
	Δy	0.0000	-0.0005	-0.0189	-0.1221	-0.1139	-0.0181	0.0748	0.1013	0.0841	0.0560	0.0115	0.0007	-0.0002	-0.0002
	ΔU	0.0000	0.0016	0.0828	0.4712	0.5287	0.4420	0.3275	0.2154	0.1301	0.0752	0.0152	0.0008	0.0002	0.0002
Tie 2	Δx	0.0000	-0.0017	-0.1026	-0.7344	-0.9918	-0.9806	-0.7590	-0.4756	-0.2555	-0.1234	-0.0194	-0.0011	0.0000	0.0000
	Δy	0.0000	-0.0006	-0.0234	-0.1563	-0.1462	-0.0200	0.0991	0.1287	0.1043	0.0681	0.0139	0.0007	-0.0003	-0.0003
	ΔU	0.0000	0.0018	0.1053	0.7509	1.0025	0.9808	0.7655	0.4927	0.2759	0.1409	0.0239	0.0013	0.0003	0.0003

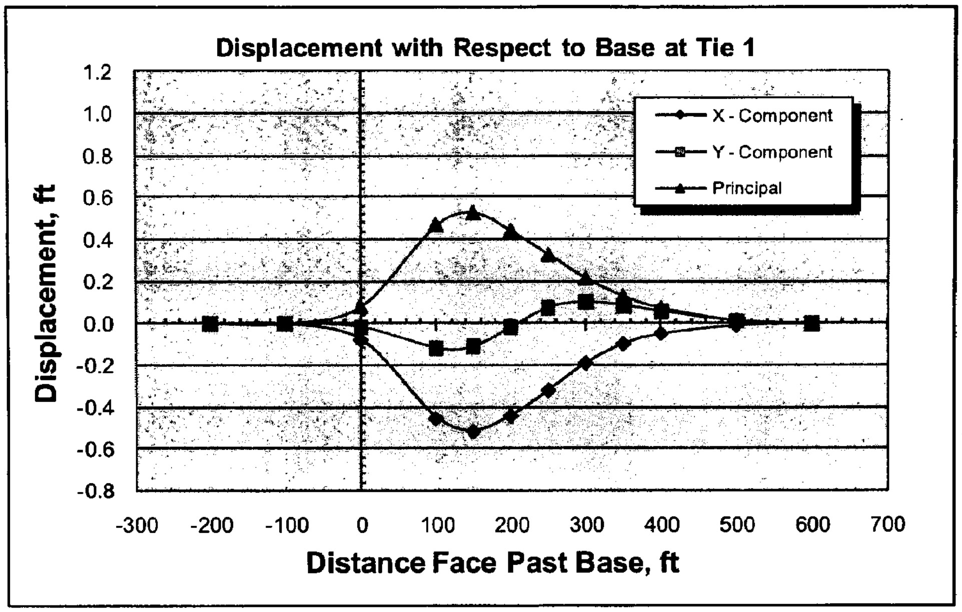


Fig. 29 Development Curves of Horizontal Displacements of Tie 1

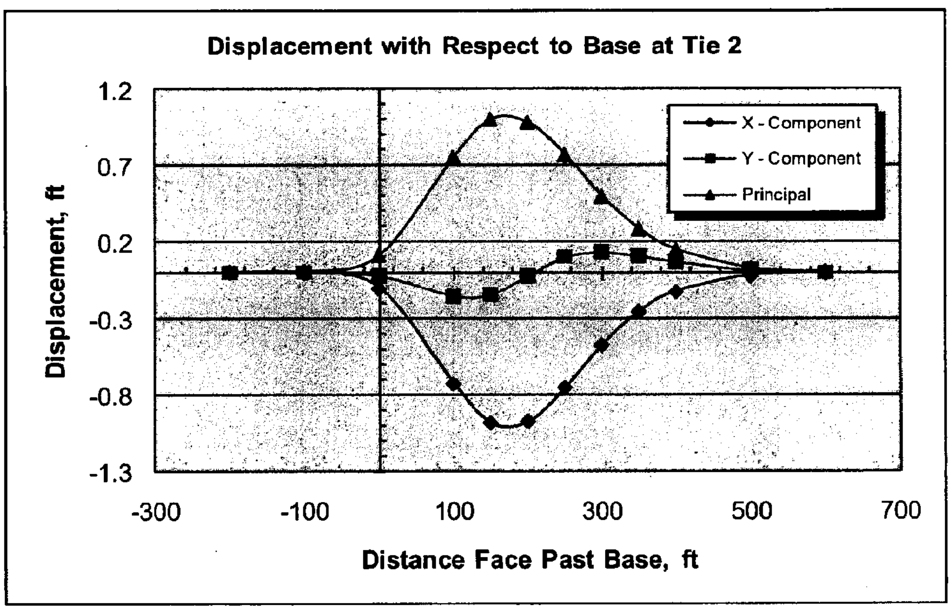


Fig. 30 Development Curves of Horizontal Displacements of Tie 2

Figure 31 shows that the force in the guy wires tied to the middle point of the tower is larger than that tied to the top. It also shows that the guy wires are all in tension before the longwall face has past the tower base a distance of 150 ft (the first phase of the subsidence phase). During the first phase, the peak tensions are 3,500 and 2,800 lbs on the wires tied to ties 1 and 2, respectively, when the face is about 100 ft past the tower base. The original tension in the guy wires were not specified in the provided tower design documents. However, a FAA representative at the time of our site visit mentioned that the tension should be between 150 and 200 lbs (seemingly a reasonable value judged by the way that the guy wires are connected to the tower as shown in Fig. 11). A 200-lbs pre-mining tension is listed in Table 1. However, a previous project on guyed tower showed that the pre-mining guy wire tensions in the magnitude of 1,000 to 2,000 lbs are commonly used. Compared to these cited original tension values, the estimated subsidence-induced peak tensions in the guy wires are high but much less than the ultimate break strengths of the guy wires (10,600 lbs for 3/8" wire rope). The guy wires at such tensions should be safe but it should not be left unattended.

In the second phase of the dynamic subsidence process especially during the time period when the longwall face is between 200 and 550 ft past the tower base, the tensions in the guy wires become nonexistent (the magnitudes of the negative values are larger than the pre-mining wire tensions). Under such condition, the tower is no longer effectively restrained laterally by the guy wires within certain small range. The lack of effective lateral restraint makes it possible for the tower, especially its upper sections, to vibrate under strong winds.

Tables 4 Determination of Tensions in Guy Wires

Tie	Anchor	Distance Face Passed the Tower Base													
		-200	-100	0	100	150	200	250	300	350	400	500	600	700	800
		Distance between Tie and Anchor, *ft*													
Tie 1	a	67.27	67.27	67.31	67.48	67.43	67.26	67.13	67.11	67.15	67.19	67.25	67.27	67.27	67.27
	b	67.16	67.16	67.20	67.37	67.32	67.15	67.02	67.00	67.04	67.08	67.14	67.16	67.16	67.16
	c	67.72	67.72	67.76	67.93	67.88	67.71	67.59	67.56	67.60	67.64	67.71	67.72	67.72	67.72
Tie 2	a	85.00	85.00	85.04	85.22	85.17	84.99	84.86	84.84	84.88	84.93	84.99	85.00	85.00	85.00
	b	84.91	84.91	84.95	85.13	85.08	84.90	84.78	84.76	84.79	84.84	84.90	84.91	84.91	84.91
	c	85.71	85.71	85.75	85.93	85.88	85.70	85.57	85.55	85.59	85.63	85.69	85.71	85.71	85.71
		Additional Strains in the Guy Wires, *ft/ft*													
Tie 1	a	0.00E+00	1.22E-05	5.81E-04	3.17E-03	2.41E-03	-1.34E-04	-1.99E-03	-2.32E-03	-1.81E-03	-1.13E-03	-2.15E-04	-1.72E-05	-7.58E-07	-7.58E-07
	b	0.00E+00	1.29E-05	5.82E-04	3.17E-03	2.41E-03	-1.34E-04	-1.98E-03	-2.32E-03	-1.81E-03	-1.13E-03	-2.10E-04	-1.75E-05	2.72E-06	2.72E-06
	c	0.00E+00	7.59E-06	5.81E-04	3.17E-03	2.42E-03	-1.34E-04	-1.99E-03	-2.32E-03	-1.82E-03	-1.13E-03	-2.15E-04	-2.04E-05	-1.93E-06	-1.93E-06
Tie 2	a	0.00E+00	9.43E-06	4.38E-04	2.54E-03	1.98E-03	-1.04E-04	-1.61E-03	-1.83E-03	-1.41E-03	-8.68E-04	-1.66E-04	-1.59E-05	-4.97E-07	-4.97E-07
	b	0.00E+00	9.28E-06	4.42E-04	2.54E-03	1.98E-03	-1.03E-04	-1.60E-03	-1.83E-03	-1.41E-03	-8.66E-04	-1.63E-04	-1.34E-05	2.53E-06	2.53E-06
	c	0.00E+00	5.85E-06	4.35E-04	2.54E-03	1.98E-03	-1.05E-04	-1.61E-03	-1.84E-03	-1.41E-03	-8.69E-04	-1.66E-04	-1.75E-05	-1.99E-06	-1.99E-06

Stiffness Used for the Guy Wires: 3/8" Wire: 1,104,466 lbs ft/ft

Tie	Anchor	Additional Forces in the Guy Wires Caused by Subsidence, *lbs**													
		-200	-100	0	100	150	200	250	300	350	400	500	600	700	800
Tie 1	a	0	13	642	3,505	2,667	-148	-2,193	-2,563	-2,004	-1,248	-237	-19	-1	-1
	b	0	14	643	3,499	2,662	-148	-2,189	-2,558	-1,998	-1,245	-232	-19	3	3
	c	0	8	642	3,506	2,668	-148	-2,196	-2,564	-2,005	-1,247	-238	-22	-2	-2
Tie 2	a	0	10	484	2,811	2,184	-115	-1,775	-2,027	-1,554	-959	-184	-18	-1	-1
	b	0	10	488	2,808	2,182	-114	-1,770	-2,022	-1,552	-957	-180	-15	3	3
	c	0	6	480	2,809	2,183	-116	-1,776	-2,028	-1,555	-960	-184	-19	-2	-2
Load on Tower		0	54	2,903	16,548	12,785								0	0

* Negative values are meaningless if their magnitudes are larger than the observed pre-mining tensions in Table 1

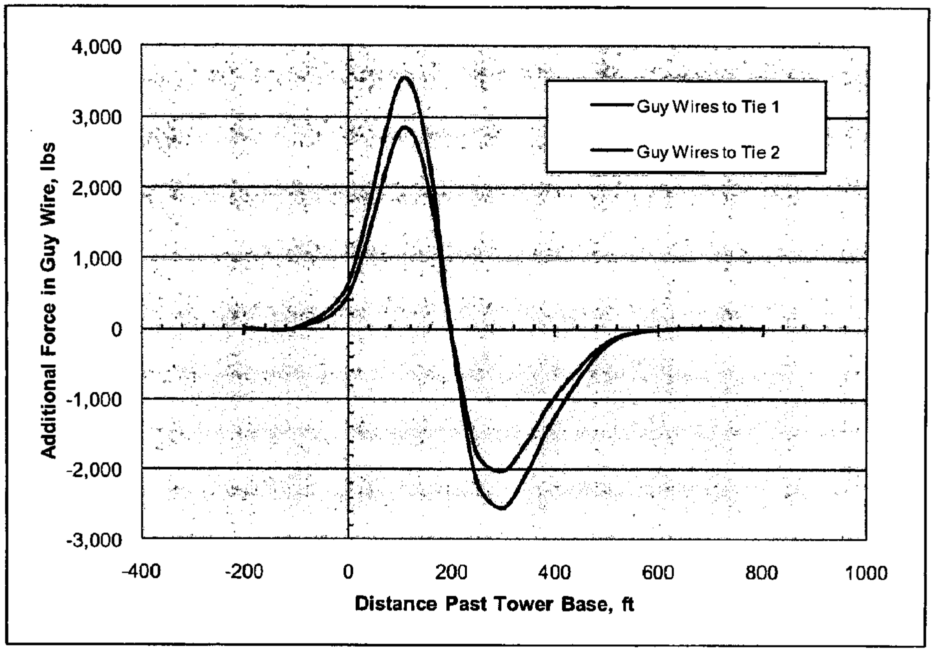


Fig. 31 Force Changes in the Guy Wires of Tower No. 3

Additional Load to the Tower

The additional tensions in the guy wires also induce additional loads to the tower structure, especially in the section near the tower base. The additional load in the lower section at a give time stage is the summation of the vertical components of the additional tensions in all of the guy wires. The resulting additional tower loads are shown also in Table 4. It shows that additional loads, up to 16,548 lbs (8.27 tons), can be induced in the first phase of the dynamic subsidence process until the longwall face has past the tower base a distance of 180 ft. Such added loads to tower base, compared to the total original weight of the tower structure and attachments, might be a source of potential problems to the tower legs.

Assessment of Structural Stability

Stability analysis is normally required for tall structure such as transmission tower to assess the potential for the structure to be toppled by external lateral forces. The guyed towers are a type of very stable tower structures that can sustain high winds, earthquakes and extreme weather when the tower structure is sufficiently restrained laterally. The stability of the guyed tower could only be jeopardized when some of the guy wires break under high tension or the guy wires would not provide the required lateral restraints to the tower. The potential tower vibration, if left unmitigated, in the second phase of the dynamic subsidence process mentioned previously could be considered as an instability problem.

Assessment of Structural Functionality

The assessment of subsidence influences on the functionality of the transmission tower is to assess whether the ground subsidence process is to disrupt or degrade the ability of the antennas on the tower to transmit and receive radio signals to and from aircrafts in the service area of this station. Such ability could be potentially affected by: (1) the blockage of the signal path, and (2) the incorrect alignment of the signal path. This section assesses the possibilities for such two potential problems to occur during and after the ground subsidence process.

Possibility of Signal Path Blockage

As shown in the final subsidence prediction, the elevations of the four radio communication towers will all be lowered by 4.08 ft. However, it should be noted that these towers are located on the top of one of the highest hills in a large area surrounding this site and the ground of nearest tree line is about 20 ft below the bases of these towers. The other hill tops in surrounding area are at least 20 ft lower than this hill. The radio antennas are at least 60 ft above their respective tower bases. It should be pointed out that the ground subsidence process will not only lower the towers but also the surrounding surface area to certain extent. Therefore, unless an aircraft in the service area is flying at low attitude behind some tall hills (uncommon for any commercial aircraft unless it is landing), in-sight straight radio signal path between the antennas and aircraft can be maintained before, during and after the subsidence event.

Possibility of Misalignment of Signal Paths

During the subsidence process, some minor inclination and rotation will develop on the tower structures. Such inclination and rotation, if large enough, might affect the alignment of the signal paths between the antennas and the flying aircrafts. In order to establish the reasonable criteria for misalignment of signal paths, the following two considerations are given:

(1) In a previous project to assess subsidence influences to a cellular communication relay tower on which a number of dish antennas were mounted, one degree of angle changes is specified as both the critical inclination and rotation. Since the pole antennas mounted on the FAA Belmont towers are less directional critical, this one degree criteria for both inclination and rotation can be relaxed.

(2) By examining the photos taken during the pre-mining site visit on April 29, 2010, many of the pole antennas were not perfectly vertical as shown in Figs. 11 and 32. Some of them may have inclinations up to 5°. It confirms that these pole antennas are not direction critical for their services.

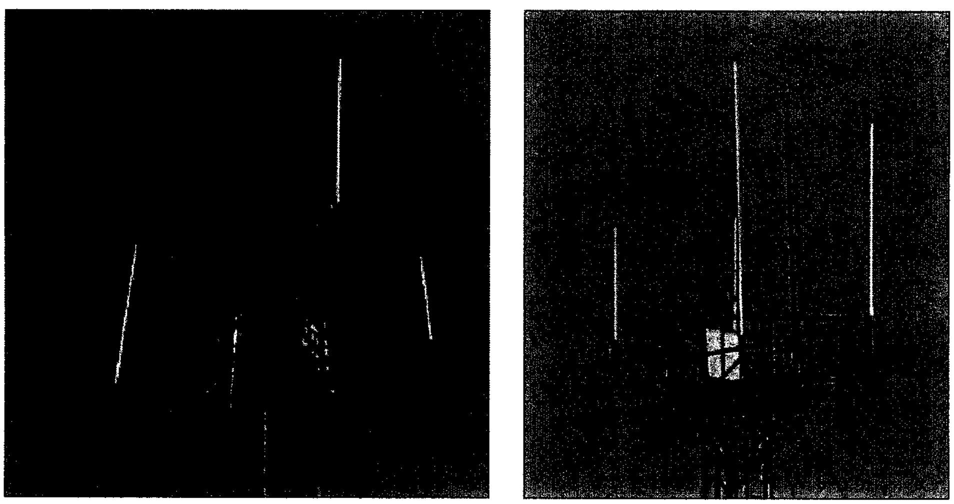


Fig. 32 Photos of the Antennas on Two Towers

The subsidence induced tower inclination and rotation have been determined so that we have the sufficient knowledge about the extents of these angular changes. Based on the determined coordinates and elevations of the tower base and the ties (Table 3), the inclinations of the tower structures away from the vertical direction at each time stage are determined for each section and the entire height of the tower. The results including inclinations along x and y directions as well as the principal one are listed in Table 5. The principal inclinations at different time stages are shown in Fig. 33. It is found that the inclination of the tower structure would be most severe when the longwall face is about 200 ft past the tower base. The maximum inclination, 1.796% (1.12°) exceeds the 1° criterion for dish antenna but less than the existing inclinations observed on the antennas.

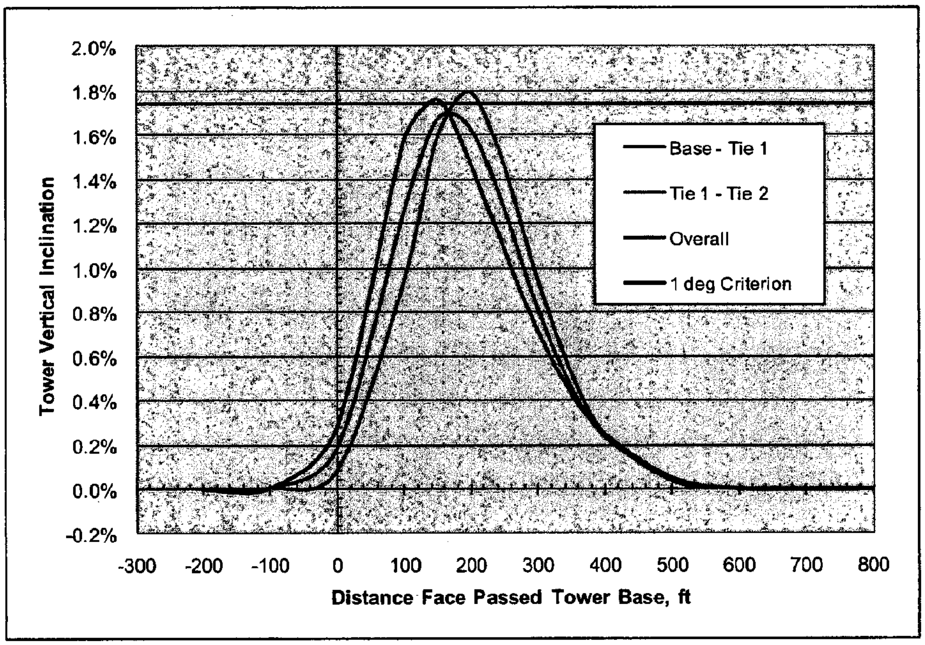


Fig. 33 Tower Inclination during Dynamic Subsidence Process

The rotation of the tower structure is determined using the coordinates of the anchors and tie 2. The determined rotations (changes in guy wire directions) at each time stage are listed in Table 6. Since the towers are located over the central portion of a supercritical panel, the subsidence process only causes a very insignificant rotation. The maximum tower rotation, only 0.12°, occurs when the longwall face is between 300 and 350 ft past the tower base.

Table 5 Determined Vertical Inclinations on the Tower Structure of No. 3 Tower

Section	Direction	Inclination of the Tower Sectional Structure													
		-200	-100	0	100	150	200	250	300	350	400	500	600	700	800
Base - Tie 1	X - Dir.	0.000%	-0.005%	-0.269%	-1.517%	-1.721%	-1.472%	-1.063%	-0.634%	-0.331%	-0.167%	-0.033%	-0.002%	0.000%	0.000%
	Y - Dir.	0.000%	-0.002%	-0.063%	-0.407%	-0.380%	-0.060%	0.249%	0.338%	0.280%	0.187%	0.038%	0.002%	-0.001%	-0.001%
	Principal	0.000%	0.005%	0.276%	1.571%	1.762%	1.473%	1.092%	0.718%	0.434%	0.251%	0.051%	0.003%	0.001%	0.001%
Tie 1 - Tie 2	X - Dir.	0.000%	-0.001%	-0.073%	-0.931%	-1.585%	-1.796%	-1.467%	-0.952%	-0.521%	-0.244%	-0.032%	-0.002%	0.000%	0.000%
	Y - Dir.	0.000%	0.000%	-0.015%	-0.114%	-0.108%	-0.006%	0.081%	0.091%	0.067%	0.041%	0.008%	0.000%	0.000%	0.000%
	Principal	0.000%	0.001%	0.075%	0.938%	1.589%	1.796%	1.470%	0.956%	0.525%	0.247%	0.033%	0.002%	0.000%	0.000%
Overall	X - Dir.	0.000%	-0.003%	-0.171%	-1.224%	-1.653%	-1.634%	-1.265%	-0.793%	-0.426%	-0.206%	-0.032%	-0.002%	0.000%	0.000%
	Y - Dir.	0.000%	-0.001%	-0.039%	-0.261%	-0.244%	-0.033%	0.165%	0.214%	0.174%	0.114%	0.023%	0.001%	-0.001%	-0.001%
	Principal	0.000%	0.003%	0.175%	1.251%	1.671%	1.635%	1.276%	0.821%	0.460%	0.235%	0.040%	0.002%	0.001%	0.001%

Table 6 Determined Horizontal Rotation of the Tower Structure of No. 3 Tower

Anchor	Directions of the Guy Wires to Tie 2*, Deg.														
	Original	-200	-100	0	100	150	200	250	300	350	400	500	600	700	800
Anchor a	11.50	11.50	11.50	11.48	11.43	11.46	11.52	11.54	11.54	11.53	11.52	11.50	11.50	11.50	11.50
Anchor b	71.57	71.57	71.57	71.56	71.47	71.46	71.53	71.61	71.64	71.63	71.61	71.58	71.57	71.57	71.57
Anchor c	-48.37	-48.37	-48.37	-48.36	-48.23	-48.18	-48.28	-48.42	-48.49	-48.48	-48.45	-48.39	-48.37	-48.37	-48.37

Anchor	Changes in Guy Wire Directions, Deg.														
	Original	-200	-100	0	100	150	200	250	300	350	400	500	600	700	800
Anchor a	0.00	0.00	0.00	-0.02	-0.07	-0.03	0.02	0.05	0.05	0.03	0.02	0.00	0.00	0.00	0.00
Anchor b	0.00	0.00	0.00	-0.01	-0.09	-0.11	-0.03	0.05	0.08	0.07	0.05	0.01	0.00	0.00	0.00
Anchor c	0.00	0.00	0.00	0.01	0.13	0.18	0.09	-0.06	-0.12	-0.12	-0.09	-0.02	0.00	0.00	0.00
Average	0.00	0.00	0.00	-0.01	-0.01	0.01	0.02	0.01	0.00	-0.01	-0.01	0.00	0.00	0.00	0.00

The analysis performed on tower No. 3 indicates that both the maximum inclination and the maximum rotation of the tower are smaller than their critical values. Therefore, the alignments of the signal paths would not be affected by the ground subsidence process associated with the longwall mining operation, either. Since tower No. 3 would be affected most by the dynamic subsidence process due to its orientations of the guy wires with respect to the mining direction, the subsidence effects on the other towers should slightly less than those anticipated in the section.

POSSIBLE EFFECTS ON BURIED CABLE CONDUITS

The buried cable conduits between the control building and the tower bases will undergo a dynamic subsidence process. The conduits could be stretched or squeezed along their respective axial directions during the dynamic subsidence process. The stretch could place significant tension on the conduits as well as the cables inside. The compression stage of the dynamic subsidence is unlikely to cause problems to the cables. In this section, the effects of the dynamic subsidence process on the cable conduits for tower No. 4 (marked as green line *d-e* in Fig. 3) have been assessed since they will be stretched most among the four groups of buried conduits. The original length of this pair of buried cable conduits is about 59.5 ft.

In assessing the influence, the dynamics subsidence and horizontal displacements along the buried conduit have been predicted for the six time stages when the longwall face is -50, 0, 50, 100, 150 and 200 ft past the base of tower No. 4. A slow face advance rate of 50 ft/day is used in the prediction. The profiles of the cable conduits for the time stages are shown in Fig. 34 as they undergo the first phase of the dynamic subsidence process. It shows that at each time stage the conduits would cover longer curved paths between the two end points *d* and *e*.

Based on the predicted profiles, the total lengths of the buried conduits at different time stages can be determined. The elongation of the conduits and average cable strain are calculated and plotted in Fig. 35. It shows that the buried conduits would be elongated up to 0.16 ft (1.9 inches) when the longwall face has past the base of tower No. 4 a distance of 100 ft. At the same time, the average tensile strain on the conduits and cables would be as high as 2.7×10^{-3} ft/ft. Such tensile strain could induce large forces on the connecting ties on the control building and on the tower without mitigation.

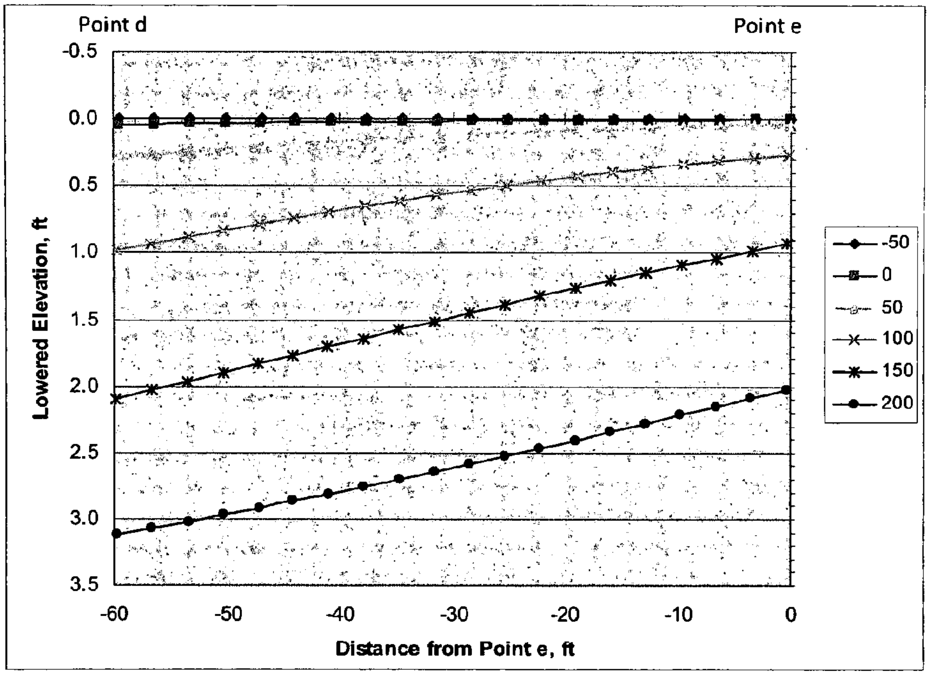


Fig. 34 Predicted Conditions of the Cable Conduits for Tower No. 4

A FAA representative at our site visit also mentioned that there is a grounding and bonding field buried in the property. It is a series of copper grounding rods that provide a grounding field needed for communications. The grounding rods for the control building are buried at the front and at the rear of the building and extend to bedrock while the grounds rods for the towers are buried beside the towers. Since no significant differential movements are expected between the burial points and the connecting lines, the subsidence events will not affect structures as well as the performance of the grounding field.

RECOMMENDED MITIGATION MEASURES

Based on the assessment of subsidence influences on the structures within the fence property of the FAA Belmont Station, the following potential problems have been identified if no proper mitigation measures are taken:

- Cracks would be induced by the dynamic tensile strain on the concrete foundation and slab floor pavement of the control building. The dynamic curvature could also cause some minor cracks to the wood frame structure. The peak dynamic slope might affect the functionality of some of the precision and equipment requiring perfect levelness (if any).

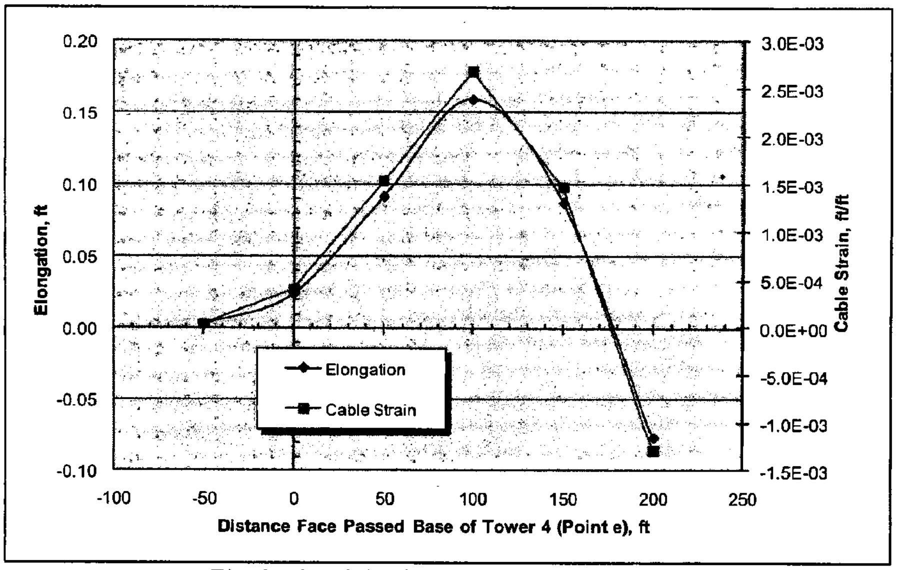


Fig. 35 Conduit Elongation and Cable Strain

- The dynamic subsidence process could also induce high additional tensions on the guy wires in the first phase of the dynamic subsidence process. The additional tensions may be able to cause structural problems to the towers. In the second phase of the dynamic subsidence process, the slack guy wires would lose effective restraints to the tower structure and would allow the tower to vibrate in strong winds.
- The buried cable conduits may be stretched excessively.

Non-Stop, Fast and Steady Longwall Retreating Operation

In order to prevent the anticipated problems from occurring on these main structures, a number of mitigation measures have been recommended. The first one is to reduce the maximum dynamic surface deformations by maintaining a non-stop, fast and steady face advance rate when the structures are experiencing the active dynamic subsidence process. A thorough maintenance should be performed to the longwall machines before the face reaching a short distance to the property. The longwall operation should be well coordinated during the time period as the face is travelling within the critical distance ranging from 50 ft inby the base of tower No. 1 to 500 ft outby the right side wall of the control building. This covers a distance of about 640 ft or about 10 days non-stop mining operations. As the prediction and the measured subsidence data indicated, the faster the face advances, the smaller the maximum dynamic deformations, particularly the maximum dynamic strain.

The past operation history has show that the mine has averaged approximately 70 ft/day of longwall face advance in 2010. In one panel with similar conditions to the 13-West panel that was mined from January through May, 2010, the longwall averaged 81 ft/day, with 89 percent of the days having over 60 ft/day advance. During that period, the longwall advance exceeded 60 ft/day on 21, 23, and 27 consecutive days; and exceeded 70 ft/day on 7, 10, 13, and 22 consecutive days. These advance rates were achieved by taking no special measures to assure that the mining does not stop. In the past, when the operation knows that there is a structure on the surface and mining must continue in a non-stop manner, preparations are made prior to reaching under the structure so that there are no long delays in the mining cycle. Therefore, the mining company should have no problem to maintain a face advance rate higher than that used in the assessments.

Tension Cable Method

In order to protect the control building, it is recommended to wrap its foundation walls with pre-tensioned steel wire cables. The tension cable method can serve the following two purposes:

- The tension force applied by the steel cables places the structure into a compression state so that it is able to compensate some of the subsidence-induced tensile stress.
- The rigidity of those structural parts is increased so that they can tolerate more deformations transmitted to it.
- The tension cable method is also capable of indirectly reducing the the anticipated problems on the super-structures caused by dynamic curvature if the deformation on the foundation can be controlled effectively.

This method has demonstrated to be very effective for protecting those structure parts that have higher compressive strength than tensile strength, such as stone, block and brick structures. Steel wire cables of ¾" diameter in good working condition would be used as the tension cables. This type of wire cable has a breaking load of 41,400 lbs far higher than the specified tensions on these cables in the project.

Two cables should be used to wrap the foundation walls as shown in Fig. 5. They should be placed at 4 and 8 inched below the top surface of concrete slab floor, respectively. Each of the cable should be tensioned to 4 tons (8,000 lbs) during the service period. A small ditch should be dug along the foundation walls so that the cable can be placed at the specified levels.

Force distributors built with wood board (1" thick and 12" wide) would be inserted between the tension cables and the structural corners (Fig. 5) so that the force applied by the tension cables can be more evenly distributed over a large area. Two tension/spring devices (An example of its construction is shown in Fig. 36) should be inserted on each of the two cables along the front and rear walls of the building (Fig. 5). The cable tensions could be periodically monitored during the active subsidence and adjusted if necessary. In the initial stage of the dynamic subsidence process, the cable tensions are expected to increase. It has been demonstrated that the cable tensions should not be reduced unless they are more than 15% higher than the specified tensions.

Guy Wire Tension Monitoring and Adjustment

During the dynamic subsidence process, the tensions on each of the guy wires should be checked two to three times a day. Since the original tension in the guy wires are not specified in the design documents, a pre-mining survey should be conducted to measure the tensions in the guy wires. The measured tensions on the guy wires tied to the middle point of the towers should be averaged and the resulting value will be used as the reference tension for the lower guy wires. The same should be done to the upper guy wires.

If measured tensions are significant different from the reference values (e.g., 50% higher or lower than the respective reference tension), the wires should be adjusted to return the tensions to the reference values. To make a required adjustment, a number of incremental rounds should be performed so that the tension on one guy wire would not be significantly higher than the others.

Uncovering and Untying the Buried Cable Conduits

In order to prevent the potential damages to the cable conduits and the cables inside, it is recommended to uncover these buried conduits. A two-foot wide uncovering trench should be made along each pair of the conduits. The depth of the trench should be as deep as the bottom of the conduits. The tying screws to affix the conduits to the control building and the towers should be taken off so that the conduits are allowed to move more freely so that no excessive forces will be developed on the conduits as well as on the attaching structures.

All of the recommended mitigation measures should be in place before the longwall face has reached within 300 ft to the property. Intensive tension monitoring should be carried out when the longwall face is travelling within the critical distance ranging from 50 ft inby the base of tower No. 1 to 500 ft outby the right side wall of the control building. The mitigation measures can be removed when the longwall face has past the property a distance of 800 ft.

CONCLUSIONS

This report covers the studies for the potential subsidence influences on a number of important structures caused by the longwall mining operation in the panel under the FAA Belmont Station. The studies include the final and dynamic subsidence predictions, the assessment of potential subsidence influences to individual structures and recommendation of mitigation measures to protect these structures. The following conclusions can made from this study:

- Without proper mitigation, the structural integrity of the control building would be affected by the dynamic tensile strain and curvature. Tension cable method is recommended to prevent material damage to this structure.
- The differential movements at the anchors and tower bases would induce high tensions on the guy wires and excessive loads on the tower legs of the four guyed towers during the first phase of the dynamic subsidence process. In the second phase of the dynamic

subsidence process, effective restrains from the guy wires to the tower structures will be lost to cause conditions for tower vibration under strong gusting wind. It is recommended to monitor the tensions in the guy wires and make any needed adjustments so that both types of the anticipated problems on these guyed towers can be avoided.

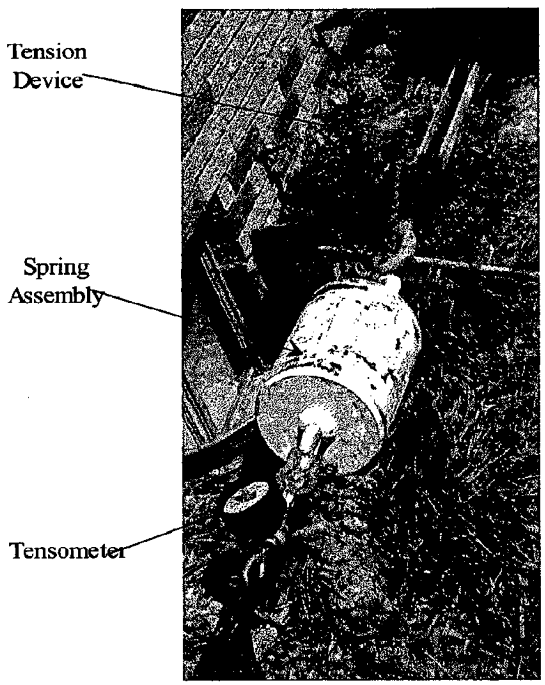
- The dynamic movements could induce significant elongation and strain on the buried cable conduits between the control building and the towers. Such elongation could cause problems to the conduits and the cables inside as well as damages to the attaching structures (i.e., the control building and the towers). In order to avoid the anticipated problems, it is recommended to uncover the buried conduits and to loosen the tying screws.
- The subsidence process is very unlikely to cause any noticeable influences to the structures other than the three main types of structures (i.e., parking lots, power pole, septic tank, leaching well and grounding and bonding field). Therefore, no detailed assessments of subsidence influences are performed for these structures nor mitigation measures needed for them.
- The water well may experience water loss during and after the subsidence event.

Based on the author's past experience with assessing and mitigating subsidence influences on numerous residential and industrial structures, the subsidence process associated with the longwall operation would not result in significant material damages and would not interrupt the services of the facility if these recommended mitigation measures are properly implemented.

REFERENCES

Luo, Y., S.S. Peng and B. Miller, 2003, "Influences of Longwall Subsidence on a Guyed Steel Tower – A Case Study," *Proc. 22nd Int'l Conference on Ground Control in Mining*, Ed. S.S. Peng, C. Mark and A.W. Khair, pp. 360-366.

Luo, Y., S.S. Peng and Z.H. Zhu, 2008, "Upgraded Comprehensive and Integrated Subsidence Prediction Model, CISPM -W", *Proc. 27th Int'l Conference on Ground Control in Mining*, Ed. S.S. Peng, et al., pp. 123-130.



Spring Assembly in Use

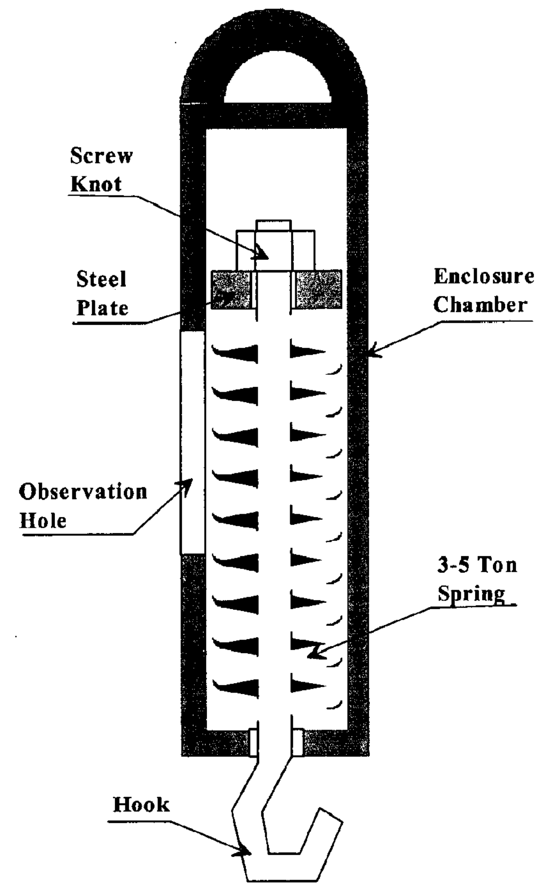


Fig. 36 Construction of the Spring Assembly

December 7, 2010

Mr. David L. Bartsch
Environmental Coordinator and Permit Administrator
The Ohio Valley Coal Company
56854 Pleasant Ridge Road
Alledonia, OH 43902

RE: Modification to 6/8/2010 Report

Dear Mr. Bartsch

The letter is to make a minor correction to the report "Assessment of Subsidence Influences and Recommended Mitigation Measures for FAA Belmont Station, Belmont, OH" submitted on June 8, 2010. It is referred to the construction and mitigation measures for the Control Building.

In the report, the super-structure of the control building was mistakenly recognized as a simple wood-frame structure. However, it was later discovered that the walls of the superstructure are built with concrete blocks and covered with siding. Due to the heavier weight of the wall structure than wood-frame structure, it is recommended to wrap the walls with one steel cable at a level about two feet below the gutter line. In order for the tension cable method to be more effective, the siding at the building corners at the cable level should be removed. Wood bracing should be inserted between the tension cable and the wall corners. The cable should be tensioned to 2.5 tons (5,000 lbs) during its service life. The cable can be removed and siding reattached after the longwall face has past the control building a distance of 600 ft.

Sincerely Your;

STATE OF OHIO
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72182
REGISTERED
PROFESSIONAL ENGINEER

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Department of Mining Engineering
West Virginia University
Morgantown, WV 26506-6070

OHIO DEPARTMENT OF NATURAL RESOURCES

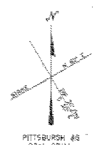
DIVISION OF MINERAL RESOURCES MANAGEMENT

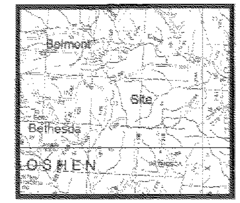
ADDENDUM TO PRE-SUBSIDENCE INVENTORY

Applicant's Name: THE OHIO VALLEY COAL COMPANY ARP

SURFACE OWNER	COUNTY	TOWNSHIP / SECTION	RENEWABLE RESOURCE	STRUCTURES - USE	MAP LOC. KEY
United States of America	Belmont	Goshen / 11		S.R. 147	21-28
			Public	Radio Towers (4)	
			Well	Aviation Communications Bldg.	W23-028.00

NOTES: 1. Surface, coal, and lease information shown herein (within the shadow area) provided by the applicant
2. The maximum overburden is 550 feet. The lowest cover overburden is 420 feet
3. The maximum area of influence from subsidence will be 24 degrees measured out from the Panel Edge. The entire application area will be included as a portion of the mining within the D-0360-43 approved mining area





Location Map - Belmont County Highway Map
Scale: 1" = 1 Mile
Quadrangle Name: Bethesda
Drainage Basin: McMahon Creek
Mapping acquired from the Belmont County GIS map

SUMMARY OF ACREAGES

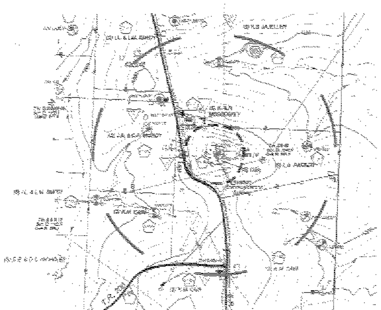
8.0 FULL COAL RECOVERY ACREAGE (ALSO LONGWALL MINING)

0 PARTIAL COAL RECOVERY ACREAGE (ALSO ROOM AND PILLAR MINING)

8.0 TOTAL COAL ACREAGE (SHADOW AREA)

LEGEND

- Site
- OCCUPIED DWELLING
- UNOCCUPIED DWELLING
- PUBLIC, COMMUNITY, INSTITUTIONAL BUILDING
- COMMERCIAL BUILDING
- CEMETERY
- ROADS INSIDE AND OUTSIDE PERMIT AREA
- PROPERTY LINE
- (S) SURFACE and NON COAL OWNER - AS SHOWN
- (C) COAL OWNER - CONSOLIDATED LAND COMPANY **
- (L) LESSEE - TOVCC **
- GAS WELL (DRY HOLE)
- EXPIRED PERMIT LOCATION
- UNKNOWN STATUS
- Producing Gas Well
- TEST BORING
- EXISTING WATER IMPOUNDMENT / POND
- PERENNIAL STREAM
- INTERMITTENT STREAM
- PROPOSED SHADOW AREA
- PARTIAL COAL RECOVERY AREA (Room & Pillar)
- 1000' HYDROLOGY LIMIT
- PRIVATE WATER SUPPLY LINE
- PUBLIC WATER
- 200 FT COVER LINE
- CISTERN
- U- UPSTREAM SAMPLING STATION
- D- DOWNSTREAM SAMPLING STATION
- W- DRILLED WELL (NO LOG AVAILABLE)
- DW- DUG WELL
- DS- DEVELOPED SPRING
- S- UNDEVELOPED SPRING
- P- WATER IMPOUNDMENT / POND
- BACKGROUND SAMPLING STATION
- MONITORING STATION
- AERIAL POWER LINE
- UNDERGROUND TELEPHONE
- AERIAL POWER AND TELEPHONE LINE
- AERIAL TELEPHONE
- GAS LINE - COLUMBIA GAS COMPANY
- GAS METER - COLUMBIA GAS COMPANY
- PERMIT D-0360
- "TOVCC" THE OHIO VALLEY COAL COMPANY
- SUBSIDENCE CONTROL SURVEY NO.
- ARCHEOLOGY UNDERGROUND NO.
- ERRIC SUBSIDENCE LINE / ANGLE OF DRAW
- WETLAND



I, THE UNDERSIGNED, HEREBY CERTIFY THAT THIS MAP IS CORRECT, AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF ALL THE INFORMATION REQUIRED BY CHAPTER 1513 OF THE REVISED CODE AND RULES ADOPTED THEREUNDER

ACKNOWLEDGED BEFORE ME A NOTARY PUBLIC THIS ___ DAY OF March, 2011

NOTARY PUBLIC

RECEIVED

ARPMAP

The Ohio Valley Coal Company
56854 Pleasant Ridge Road, Alledonia, Ohio, 43902

SECTION: 11	
T - 7 R - 5	TWP. - Goshen
COUNTY: Belmont	CONTOUR INTERVAL: 20'
SCALE: 1" = 500'	
DATE PREPARED: July 22, 2010	
DRAWN BY: db	

56854 Pleasant Ridge Rd.
Alledonia, OH 43902
Phone: 740.926.1351
Fax: 740.926.1615

OPERATOR